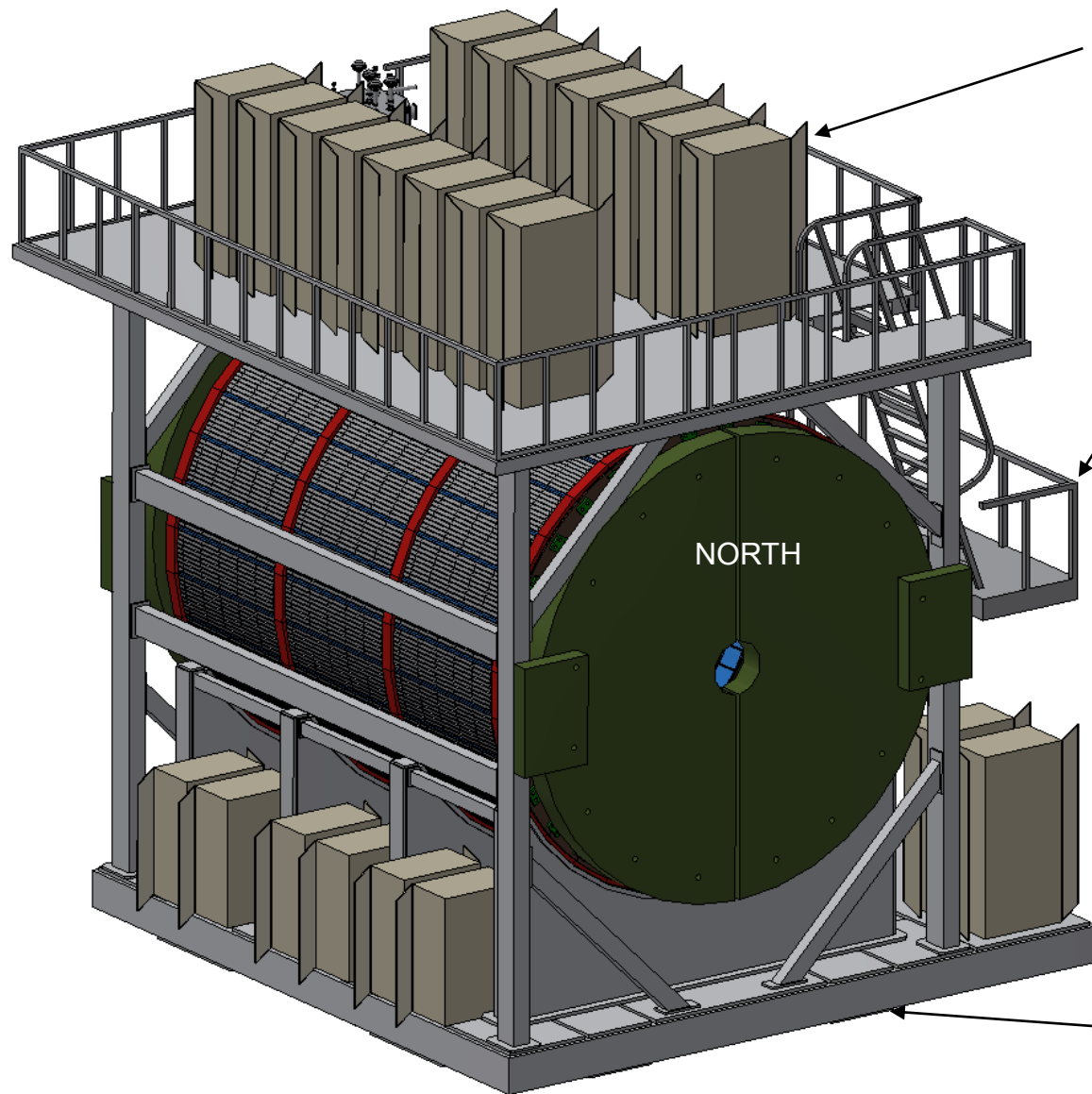
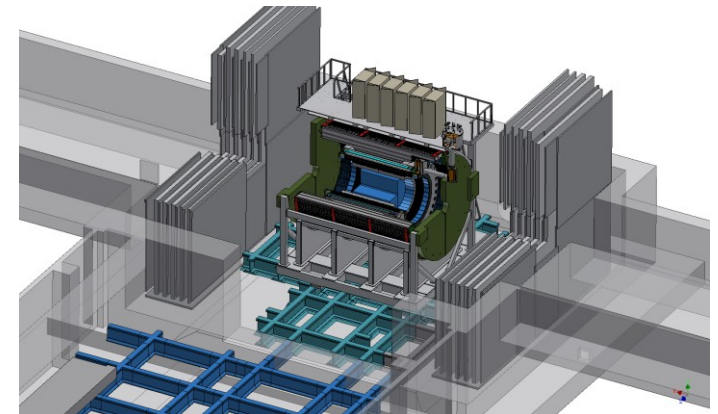


SPHENIX HCAL ASSEMBLY & INSTALLATION



21+ *ELECTRONIC RACKS*

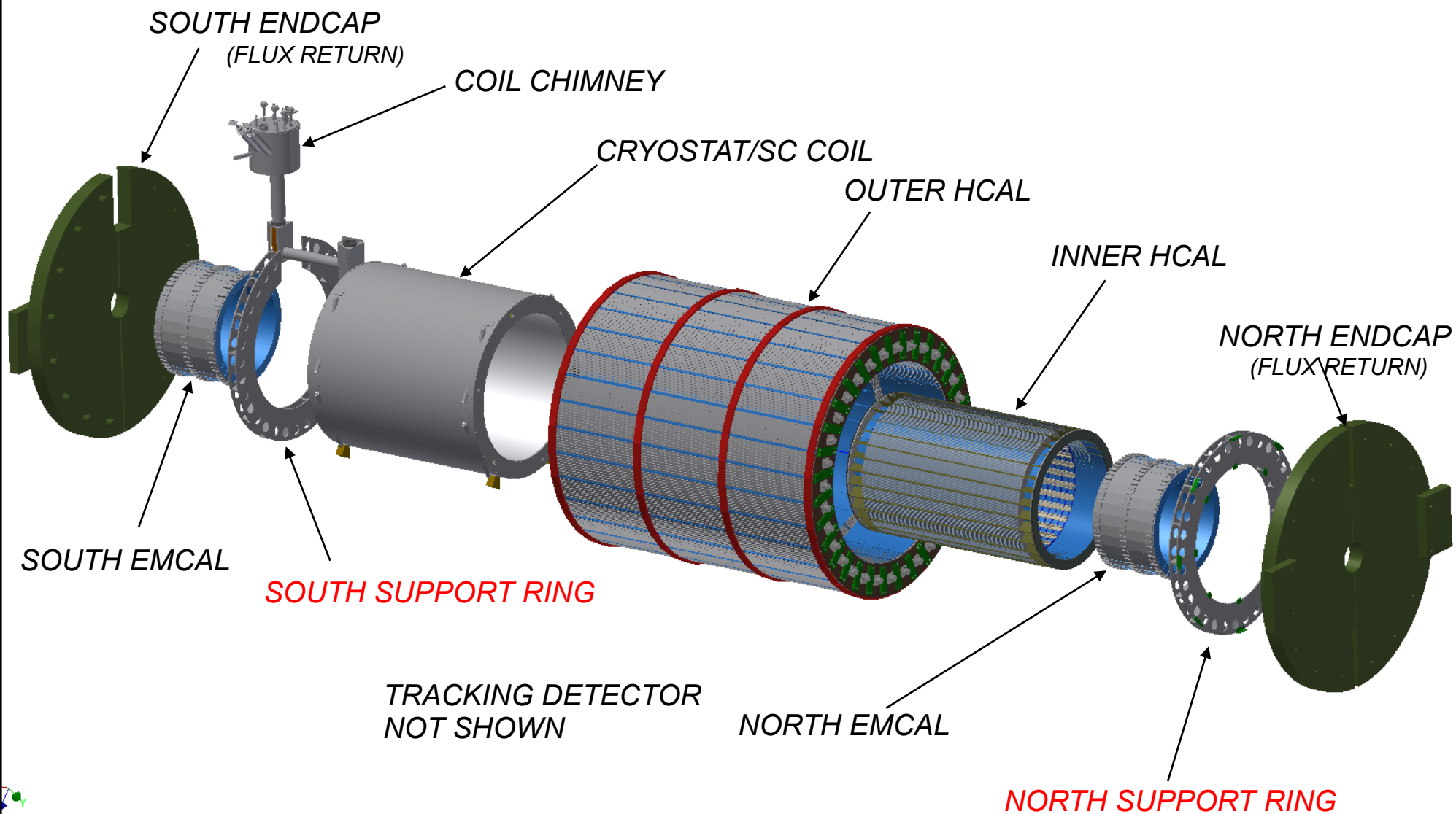
*ENTIRE EXPERIMENT
ON A SINGLE MOVEABLE
SUPPORT STRUCTURE WITH
BUILT IN ACCESS PLATFORMS*



2 SETS OF ROLLERS ALLOW
EXPERIMENT TO MOVE BOTH
NORTH-SOUTH & EAST-WEST

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SPHENIX EXPLODED VIEW

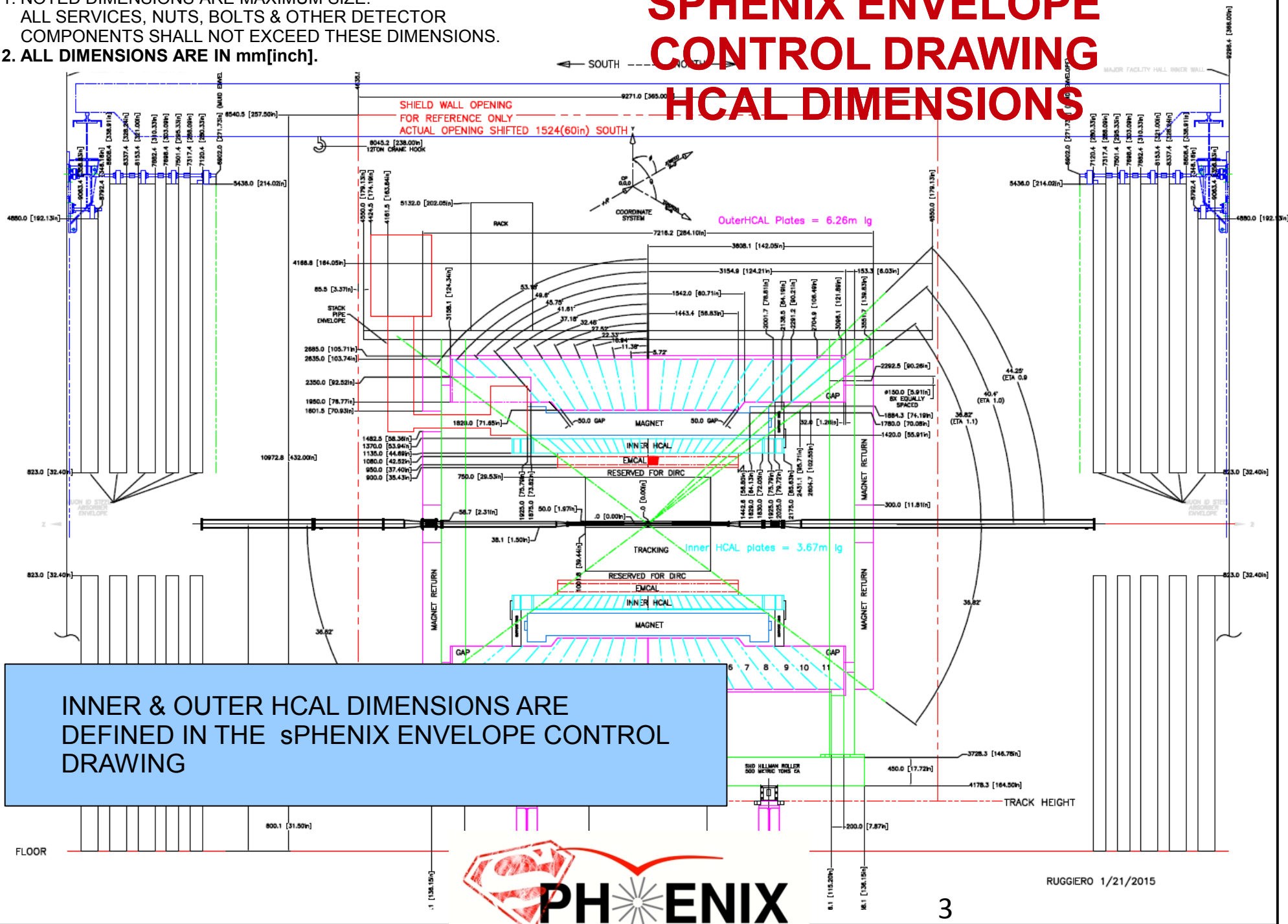


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NOTES:

1. NOTED DIMENSIONS ARE MAXIMUM SIZE.
ALL SERVICES, NUTS, BOLTS & OTHER DETECTOR COMPONENTS SHALL NOT EXCEED THESE DIMENSIONS.
2. ALL DIMENSIONS ARE IN mm[inch].

SPHENIX ENVELOPE CONTROL DRAWING HCAL DIMENSIONS

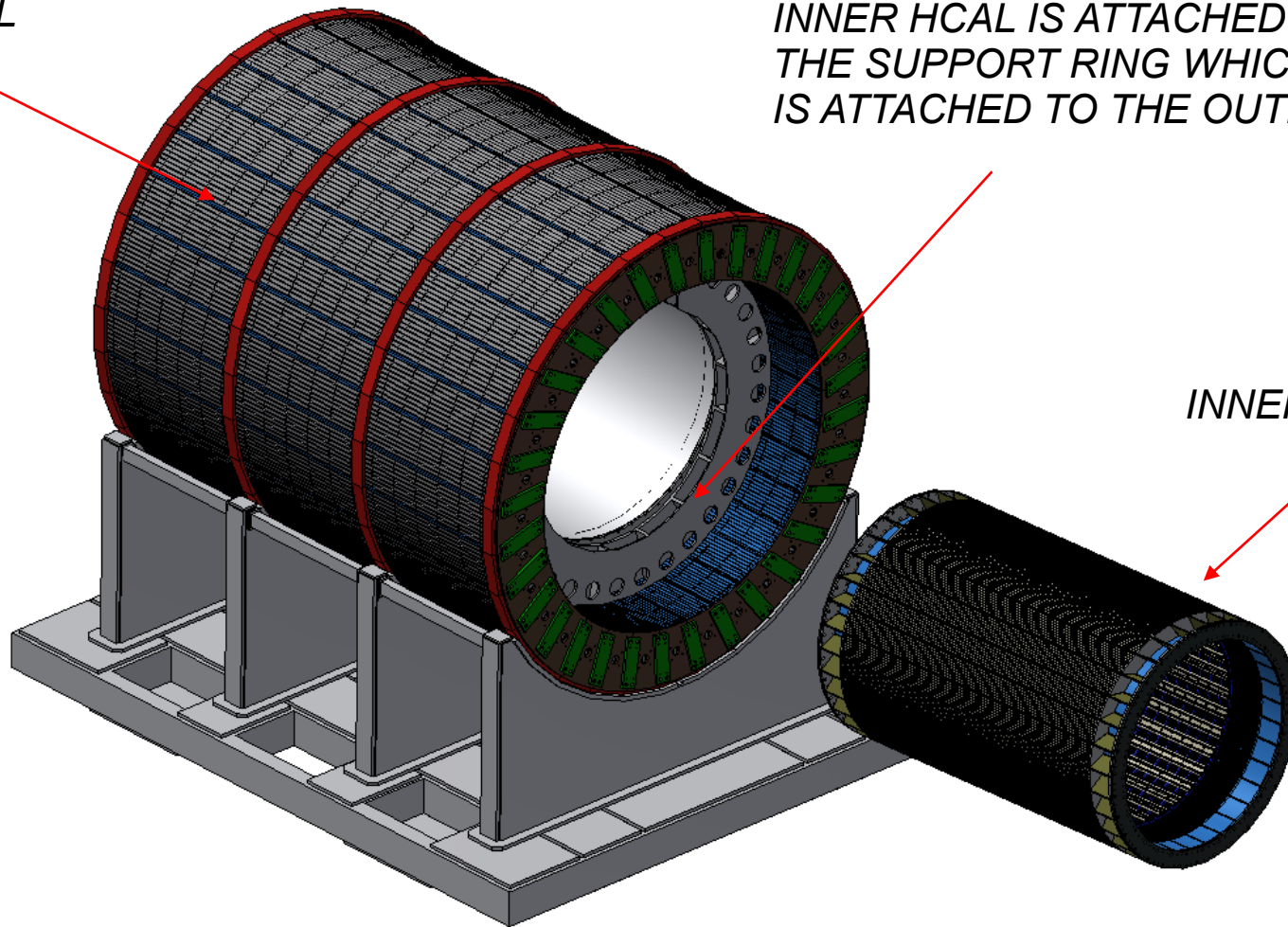


HCAL OVERVIEW

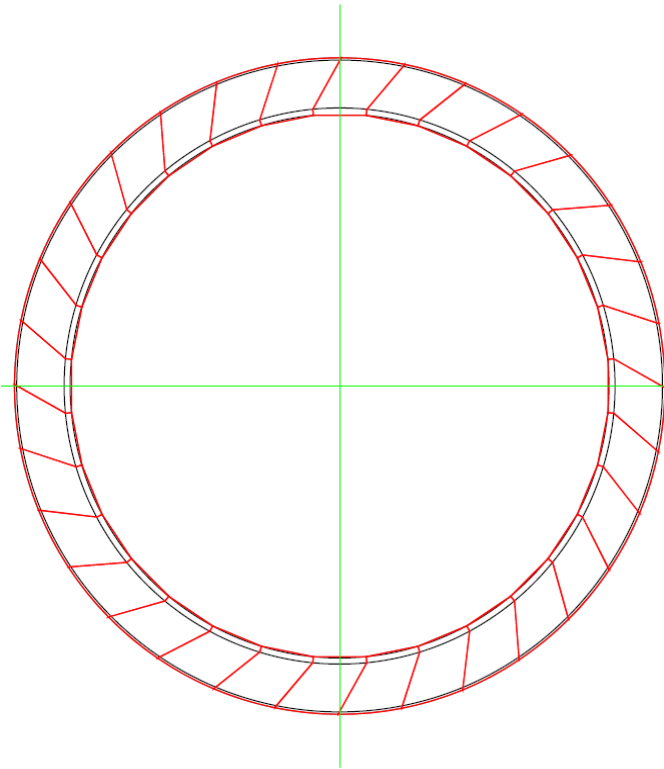
OUTER HCAL

INNER HCAL IS ATTACHED TO
THE SUPPORT RING WHICH
IS ATTACHED TO THE OUTER HCAL.

INNER HCAL



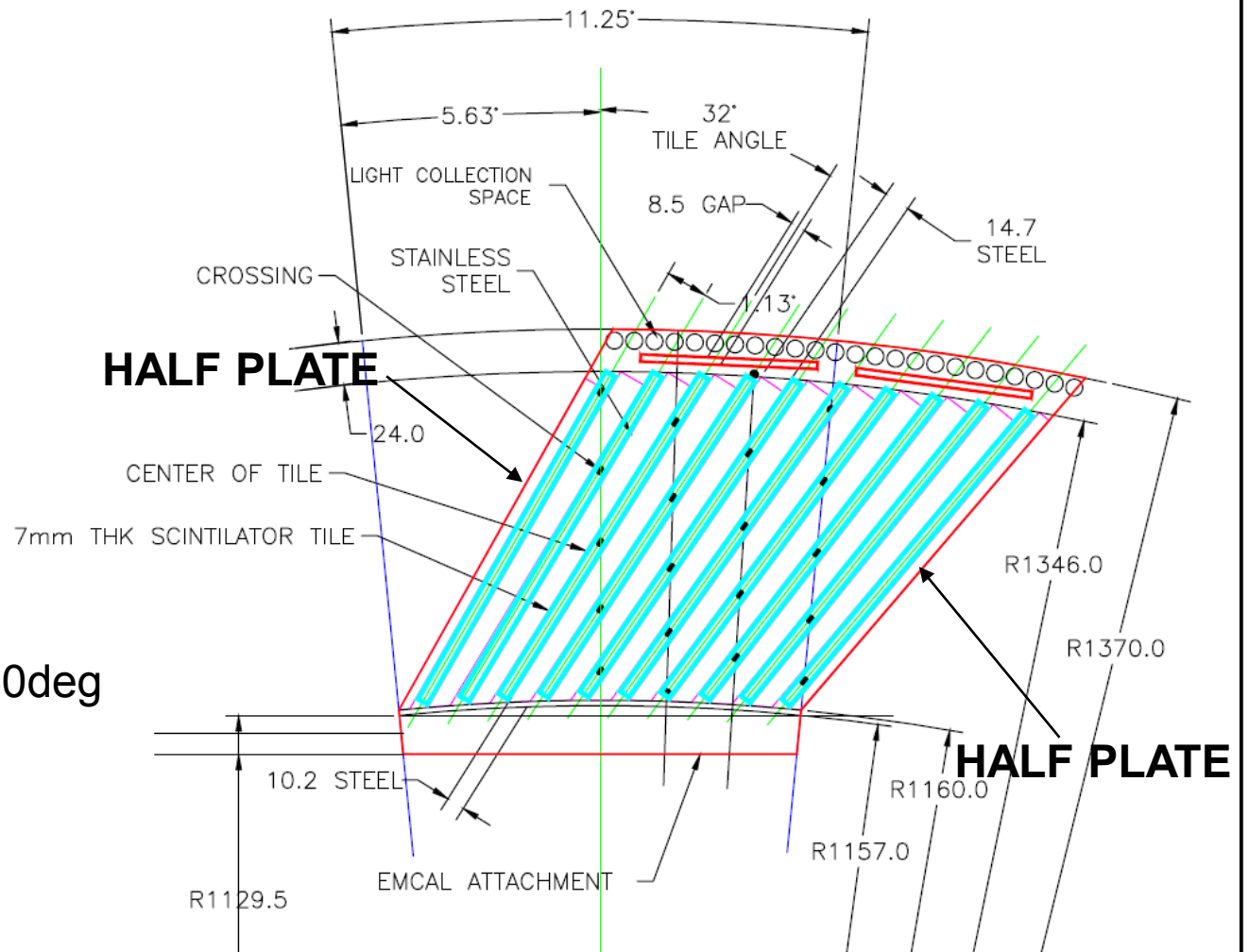
INNER HCAL GEOMETRY



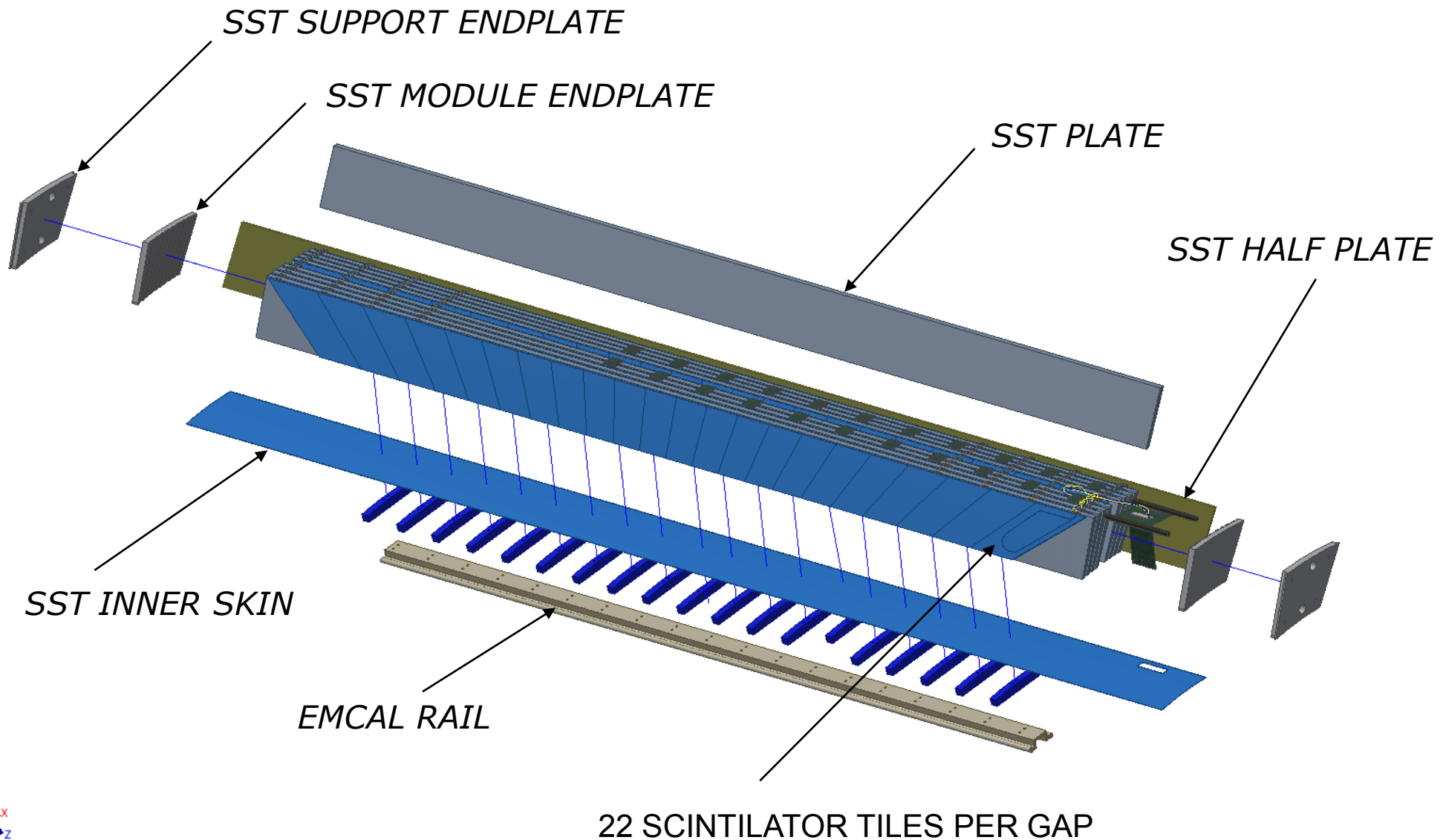
32 MODULES COVERING 360deg

INNER RADIUS ENVELOPE -1.16m
OUTER RADIUS ENVELOPE - 1.37m

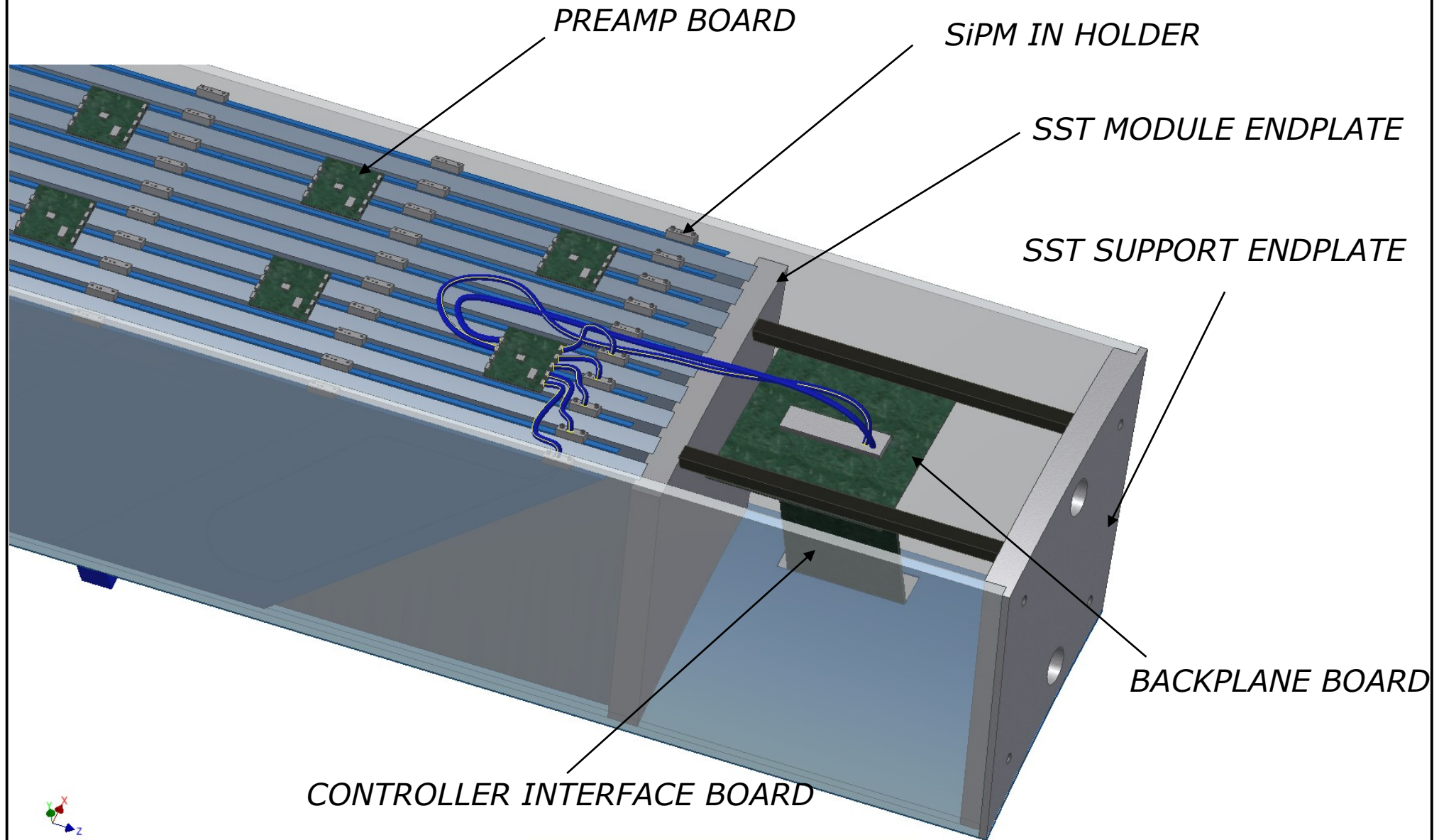
10 ROWS of 7mm Scint Tiles
22 Tiles in each row.
32deg Tilt Angle
~10.2mm – ~14.7mm Tapered SST 304 Plates



INNER HCAL MODULE CONSTRUCTION



INNER HCAL ELECTRONICS & CABLE ROUTING

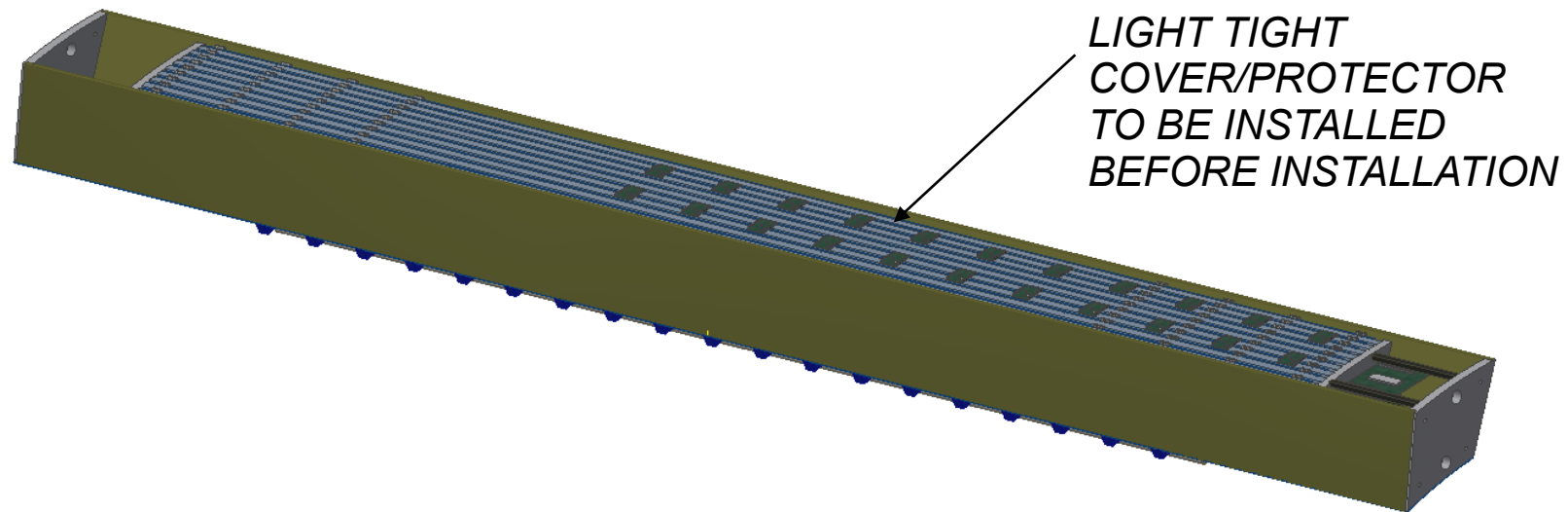


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INNER HCAL MODULE

COMPLETED MODULE

4.3m LG
1 TON



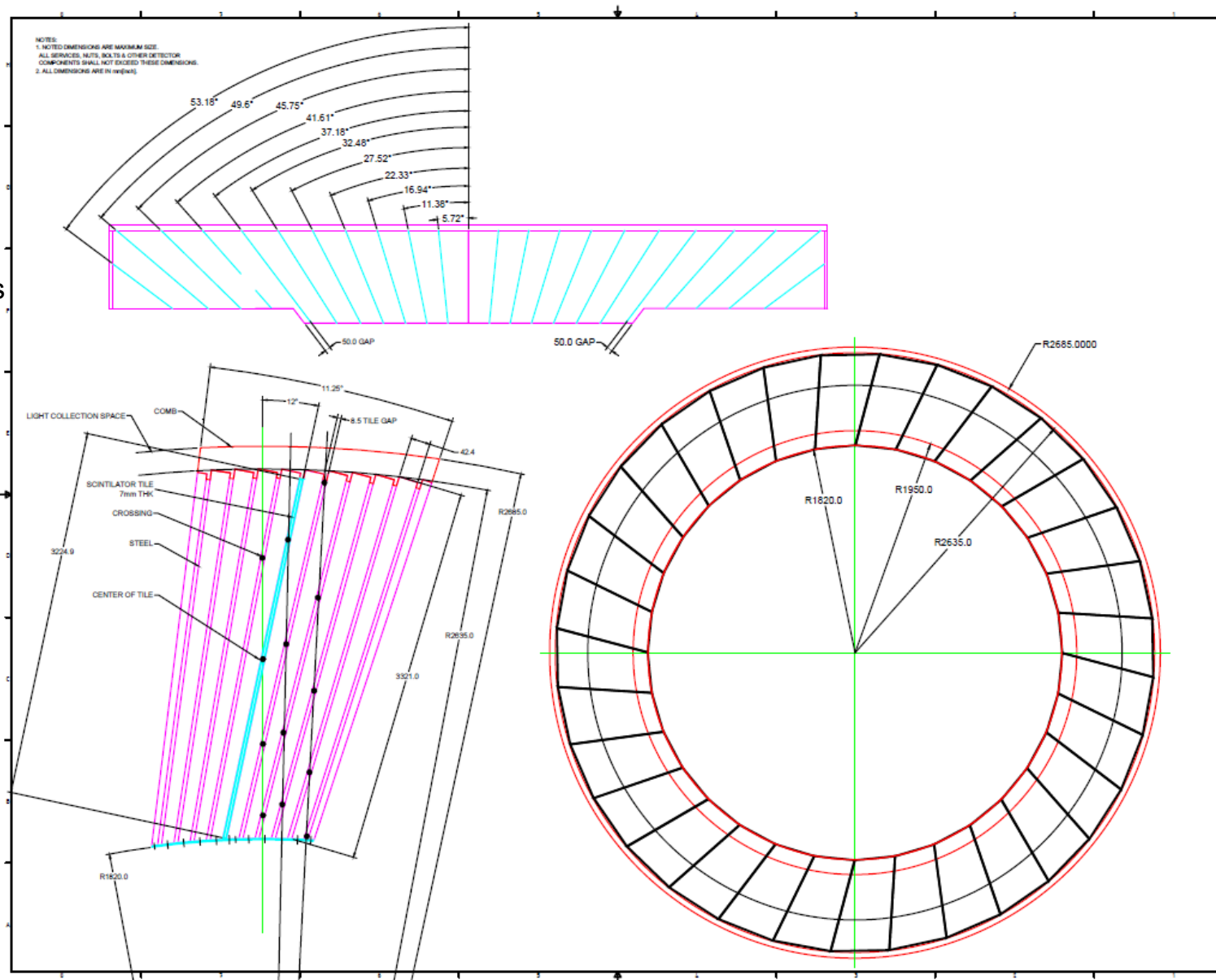
OUTER HCAL GEOMETRY

32 MODULES

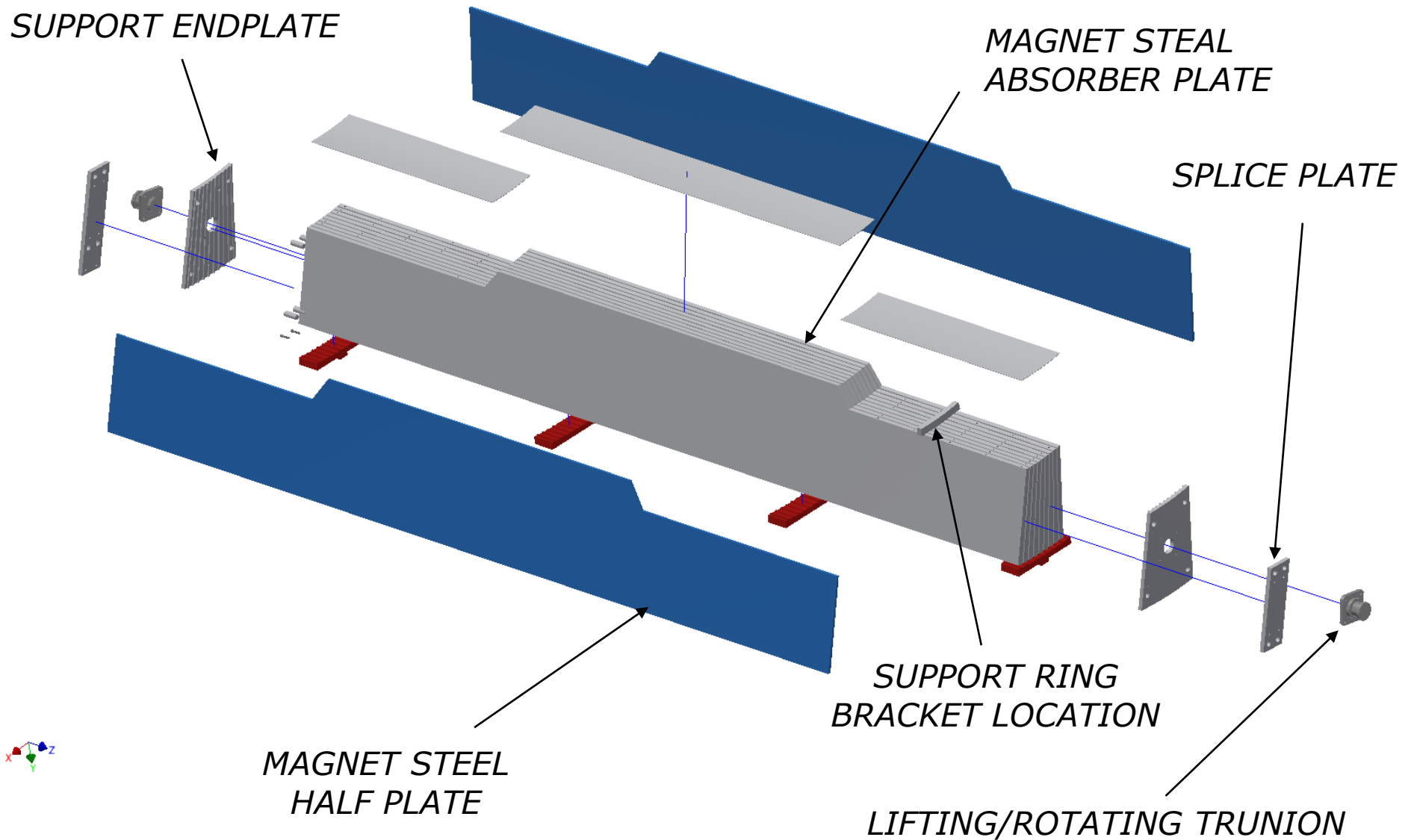
INNER RADIUS 1.9m
OUTER RADIUS 2.6m

10 ROWS of 7mm Scint Tiles
22 Tiles in each row.

~26.1mm - ~42.4mm
Tapered 1006 Steel Plates



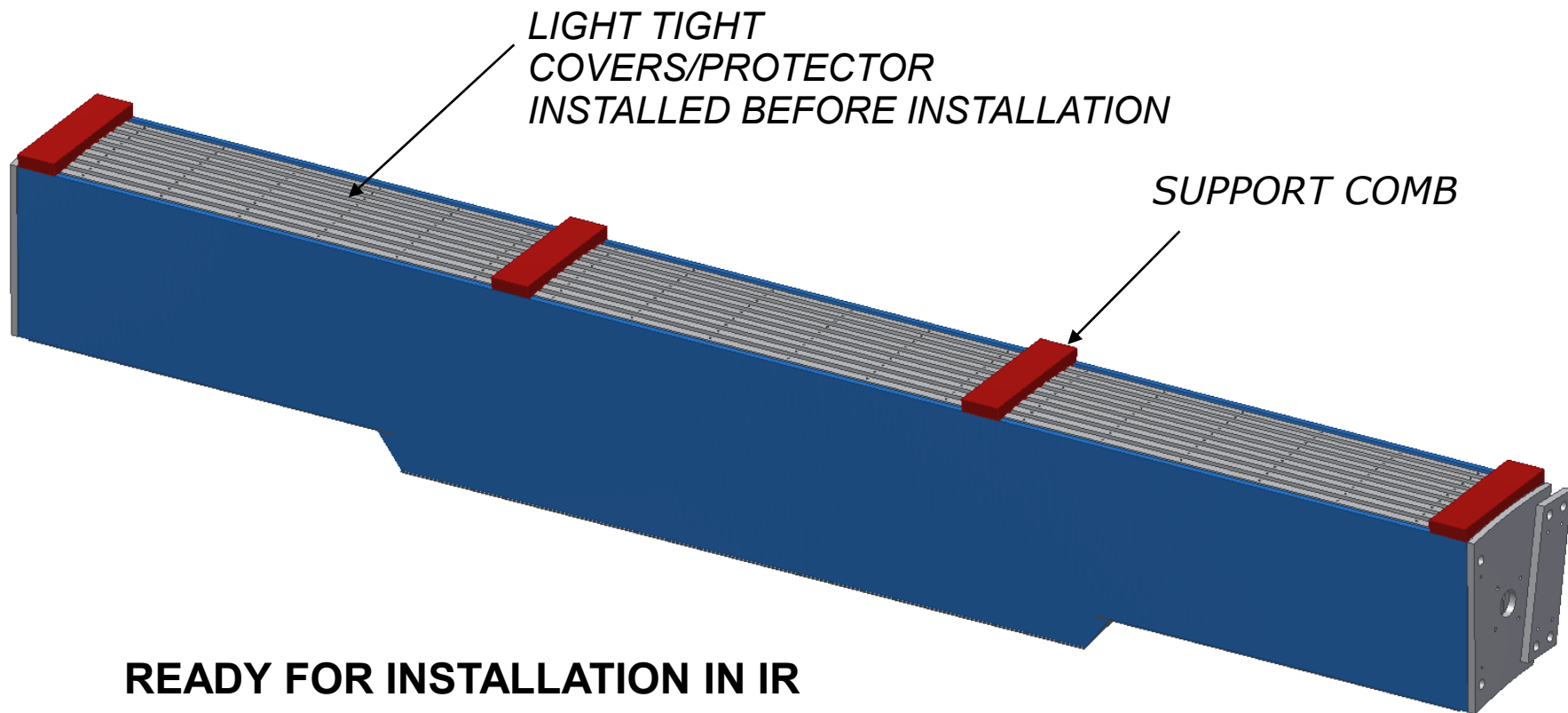
OUTER HCAL MODULE - LOWER



2/23/2015

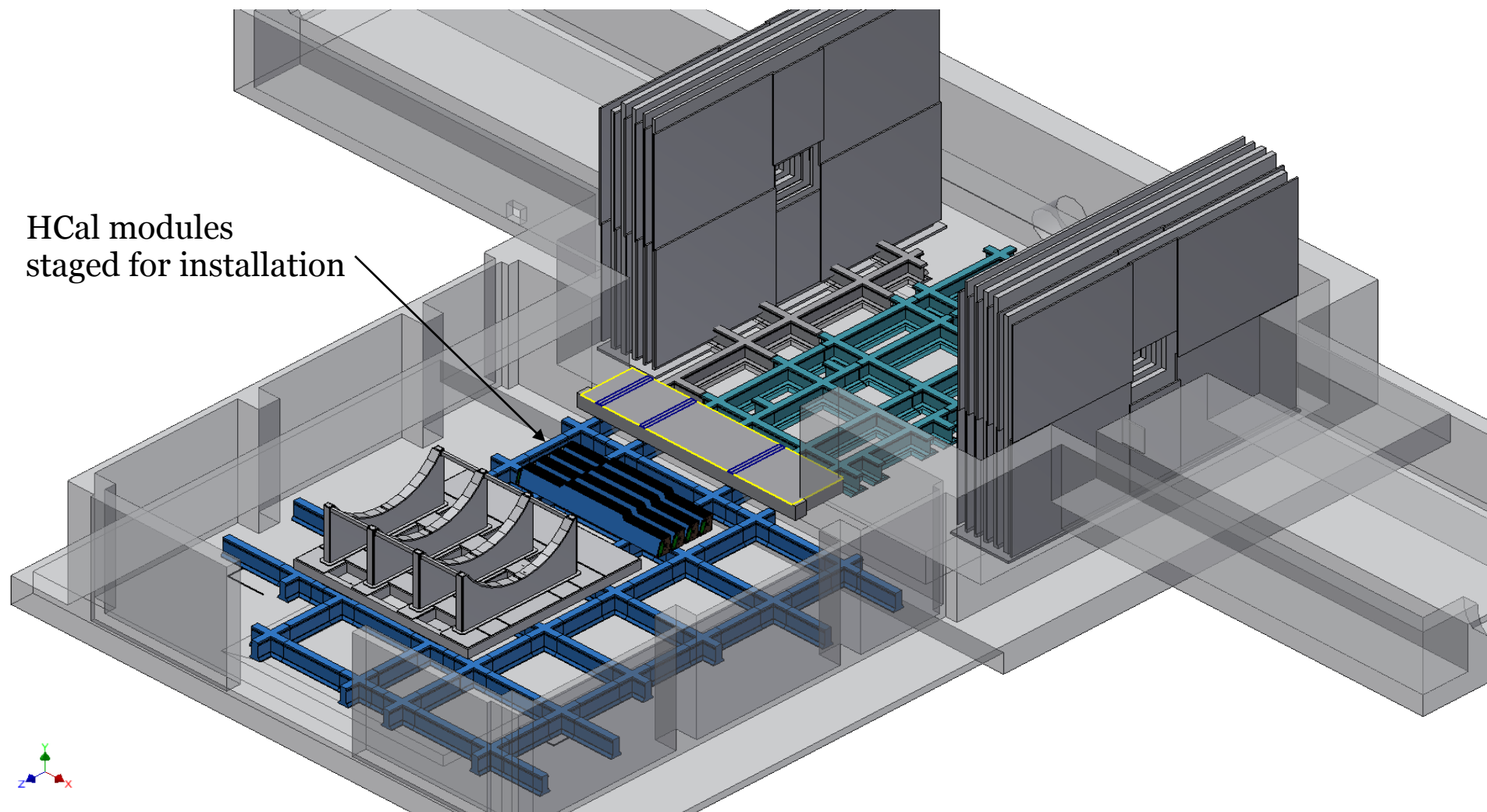
OUTER HCAL MODULE

COMPLETED MODULE 6.3m LG
13.5 TONS



READY FOR INSTALLATION IN IR

HCal MODULE INSTALLATION



1ST HCAL MODULE INSTALLATION

LIFTING/ROTATING TRUNION

1ST MODULE SHIMMED/SURVEYED
AND KEYED IN PLACE

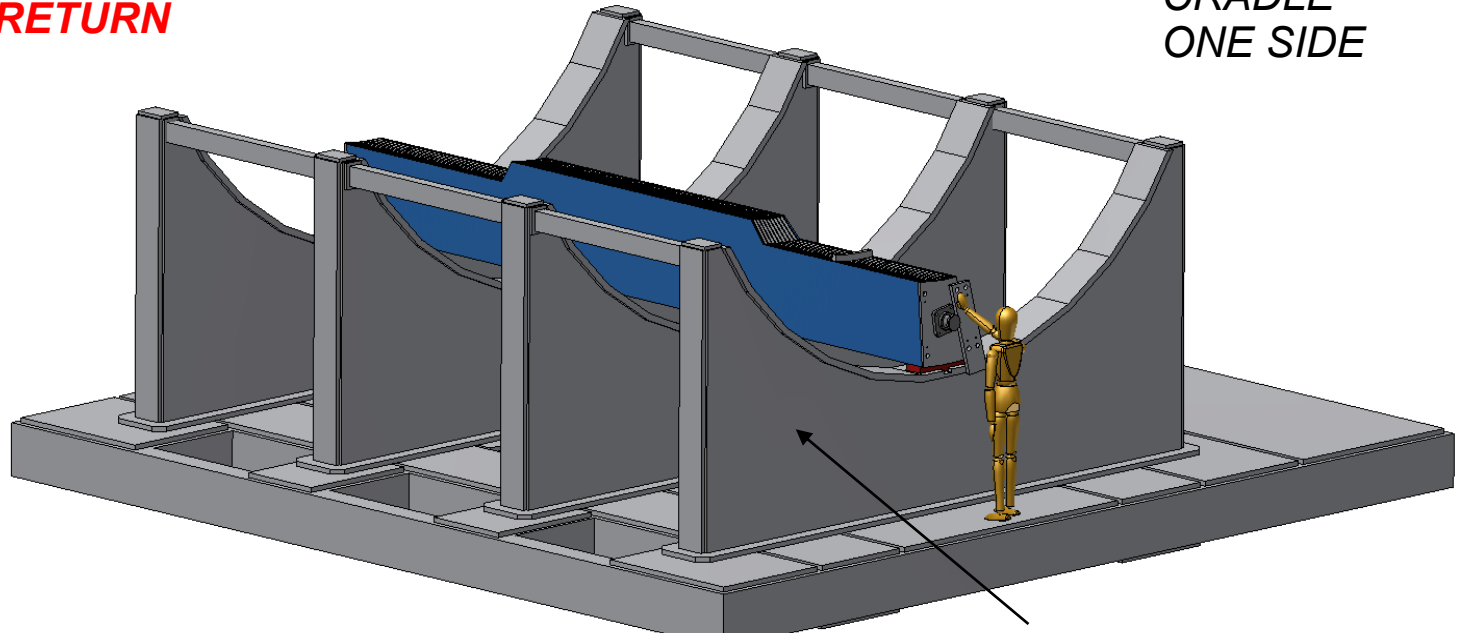
SHIM HERE

**OUTER HCAL SERVES AS THE
SUPPORT STRUCTURE FOR THE DETECTOR
AND MAGNET FLUX RETURN**

PINNED TO
NEXT
MODULE

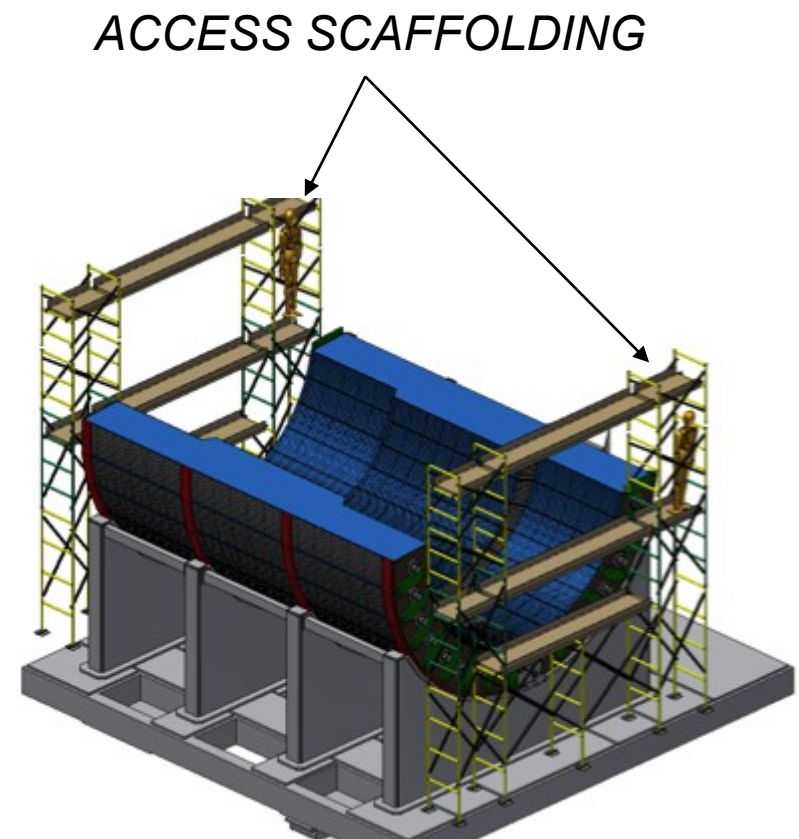
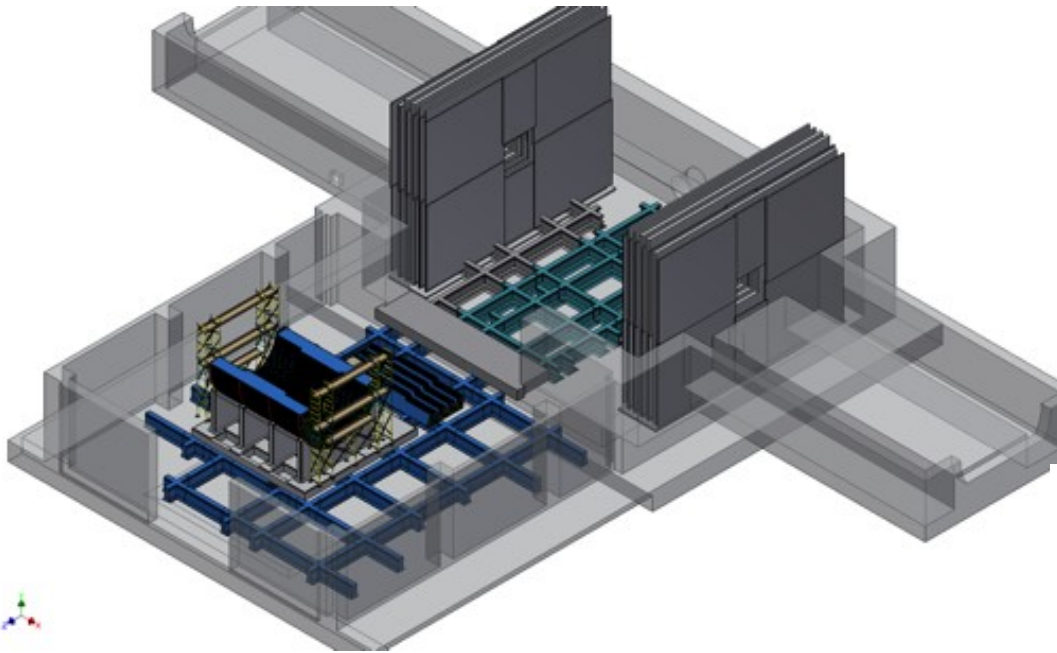
BOLTED TO
ENDPLATES

BOLTED TO
CRADLE
ONE SIDE

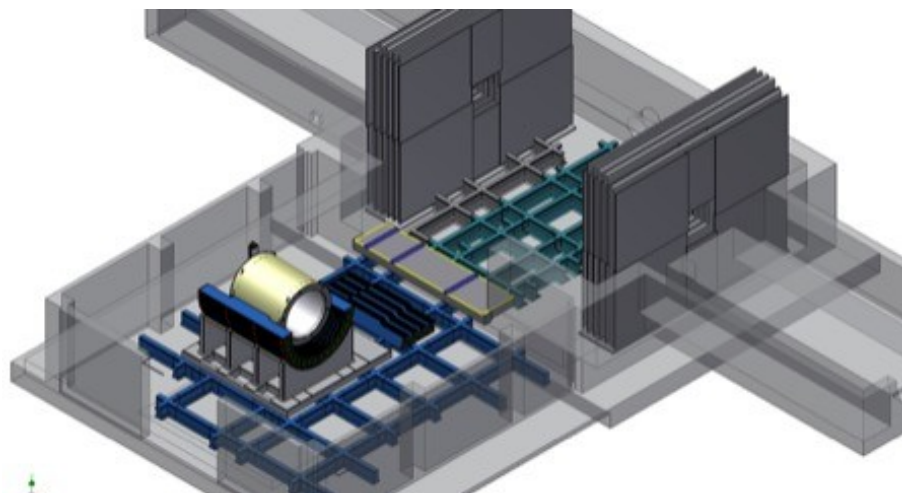


2/23/2015

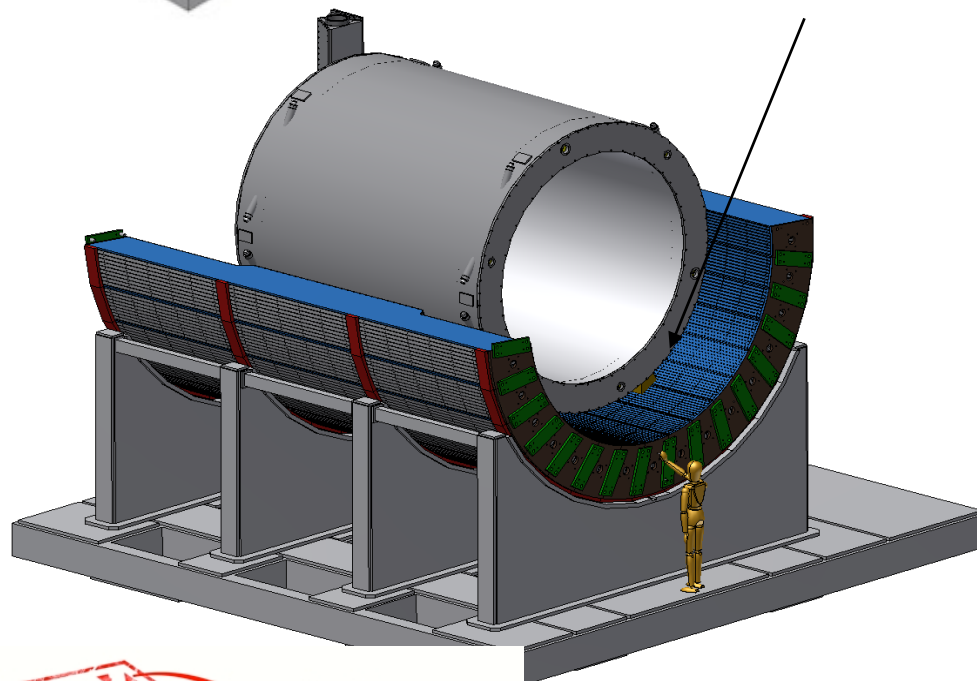
OUTER HCAL LOWER HALF INSTALLATION



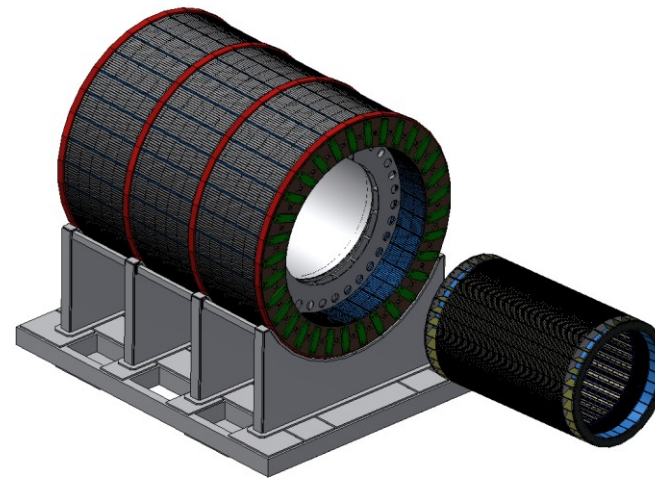
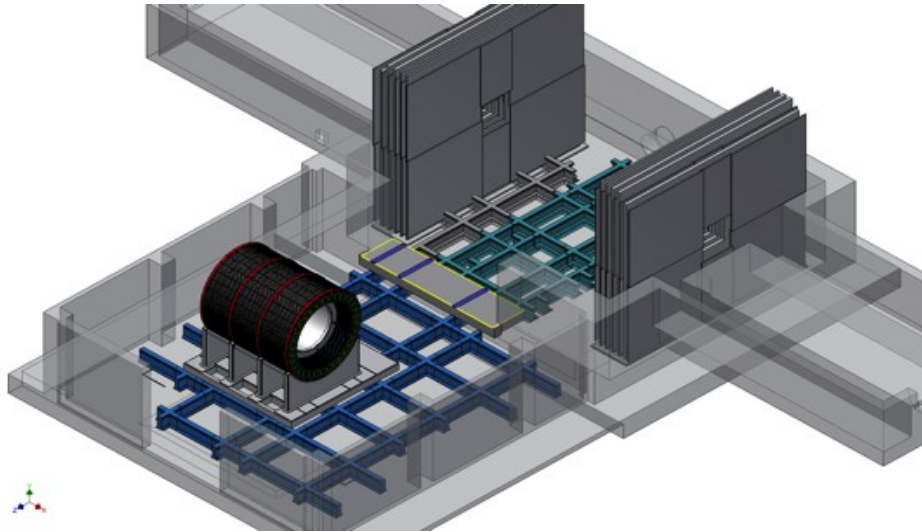
CRYOSTAT INSTALLATION



*CRYOSTAT IS SUPPORTED
BY THE OUTER HCAL*

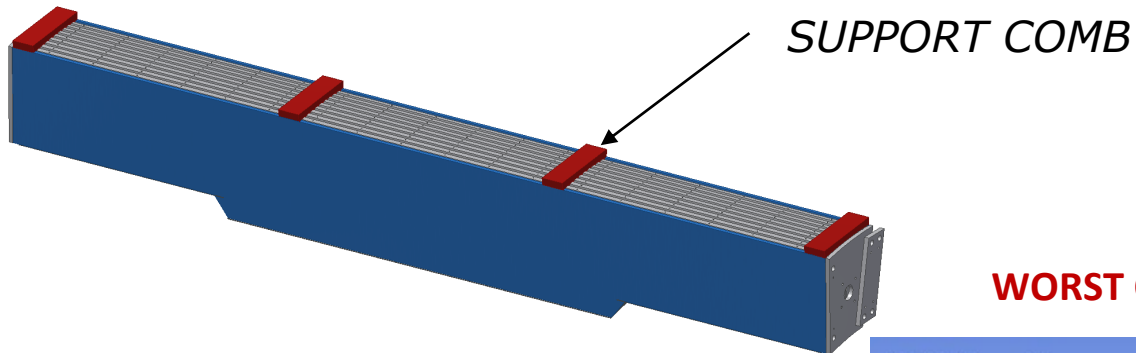


COMPLETING OUTER AND INNER HCAL INSTALLATION



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OUTER HCAL MODULE ANALYSIS

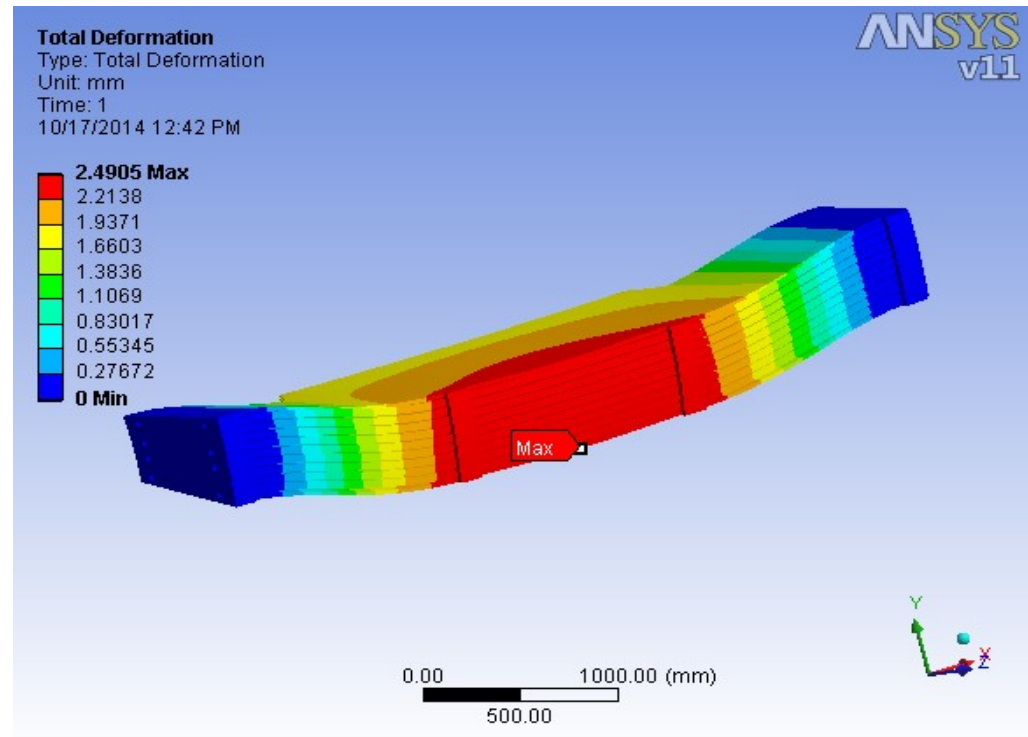


WORST CASE SCENARIO – HORIZONTAL LIFT

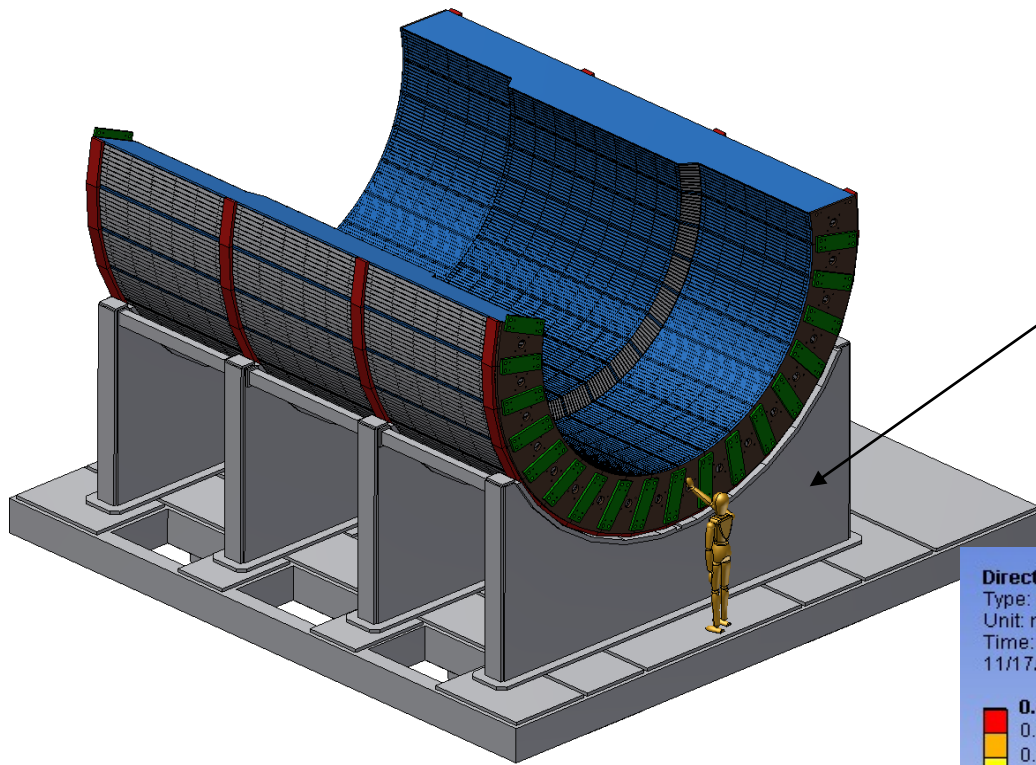
TOTAL DEFORMATION
WITHOUT SUPPORT COMBS 4.6mm

TOTAL DEFORMATION
WITH 4 SUPPORT COMBS 2.5mm

MORE COMBS?

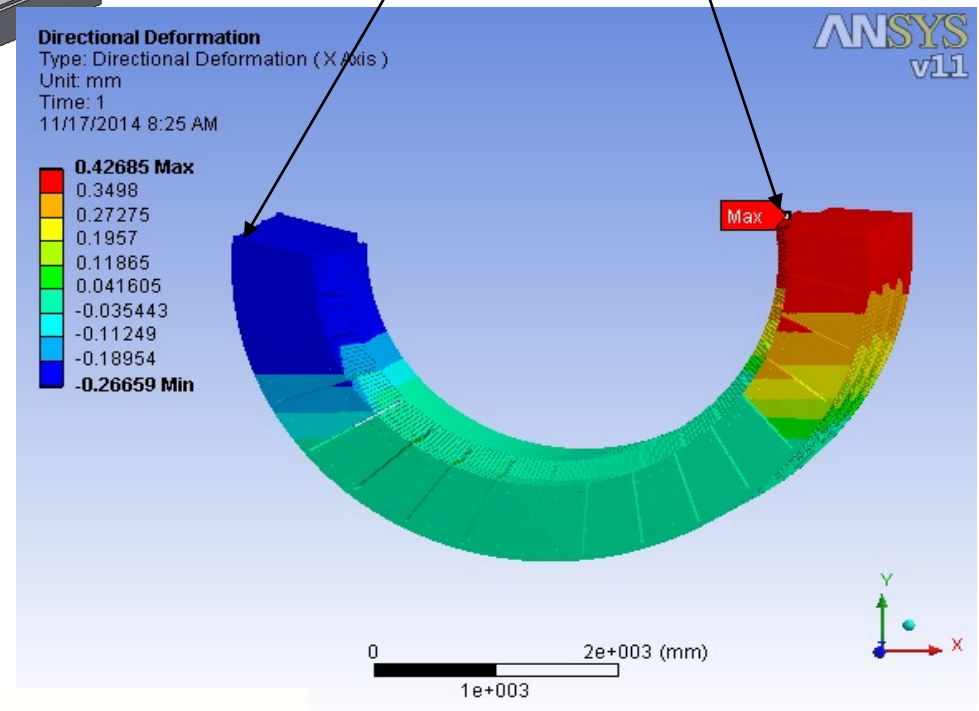


~180 deg OUTER HCAL ASSEMBLED



120 DEGREE OR MORE
BOTTOM SUPPORT
WILL BE SUFFICIENT

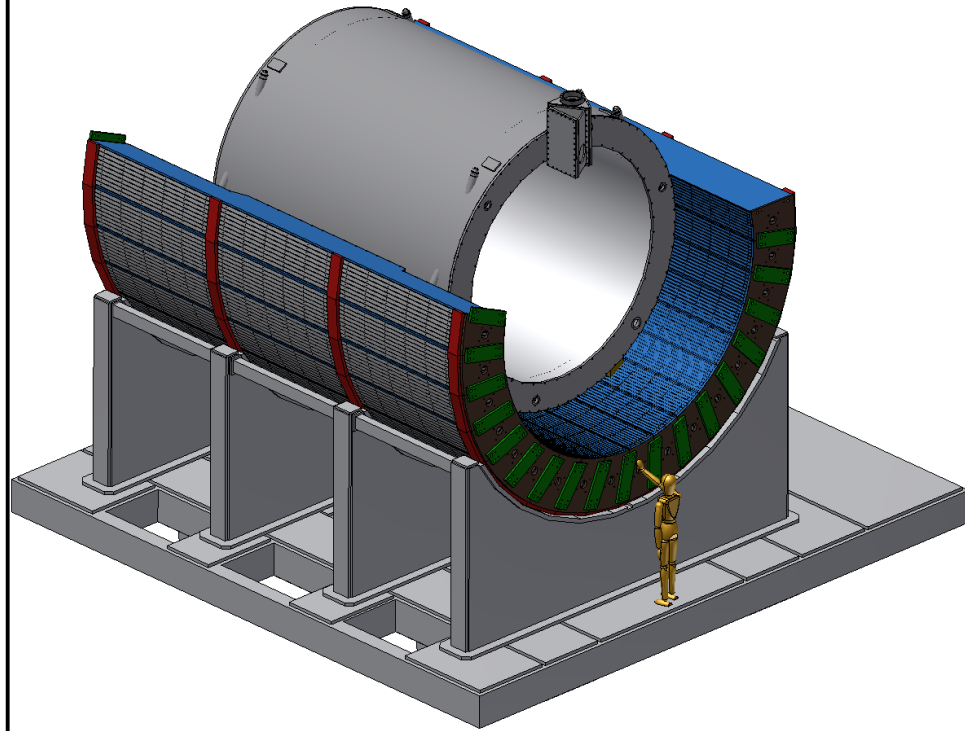
TOTAL DEFORMATION IS 0.4mm MAX



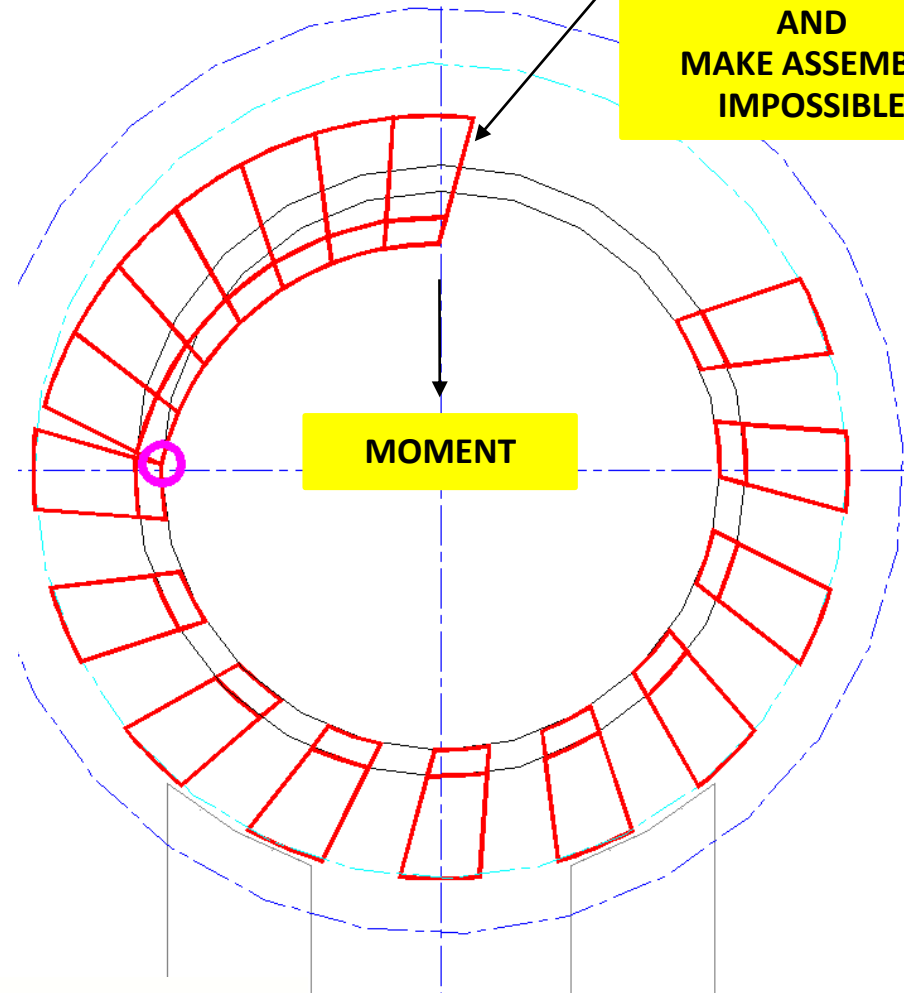
2/23/2015

ASSEMBLE UPPER QUADRANT

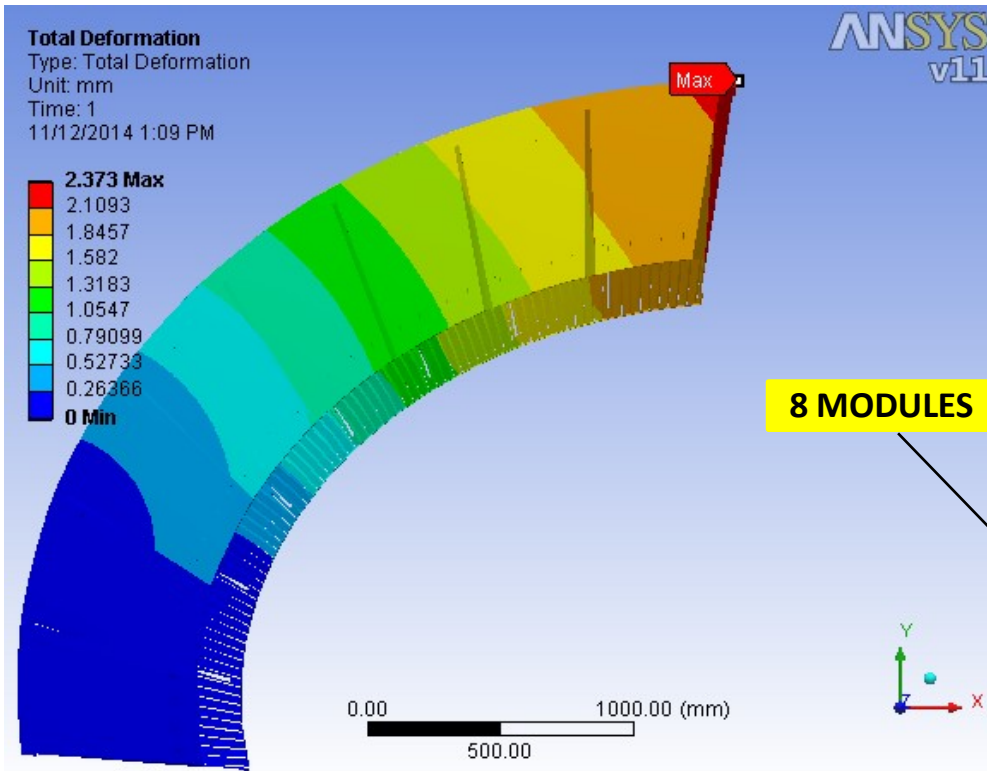
AFTER MAGNET IS INSTALLED
REMAINING MODULES ARE INSTALLED



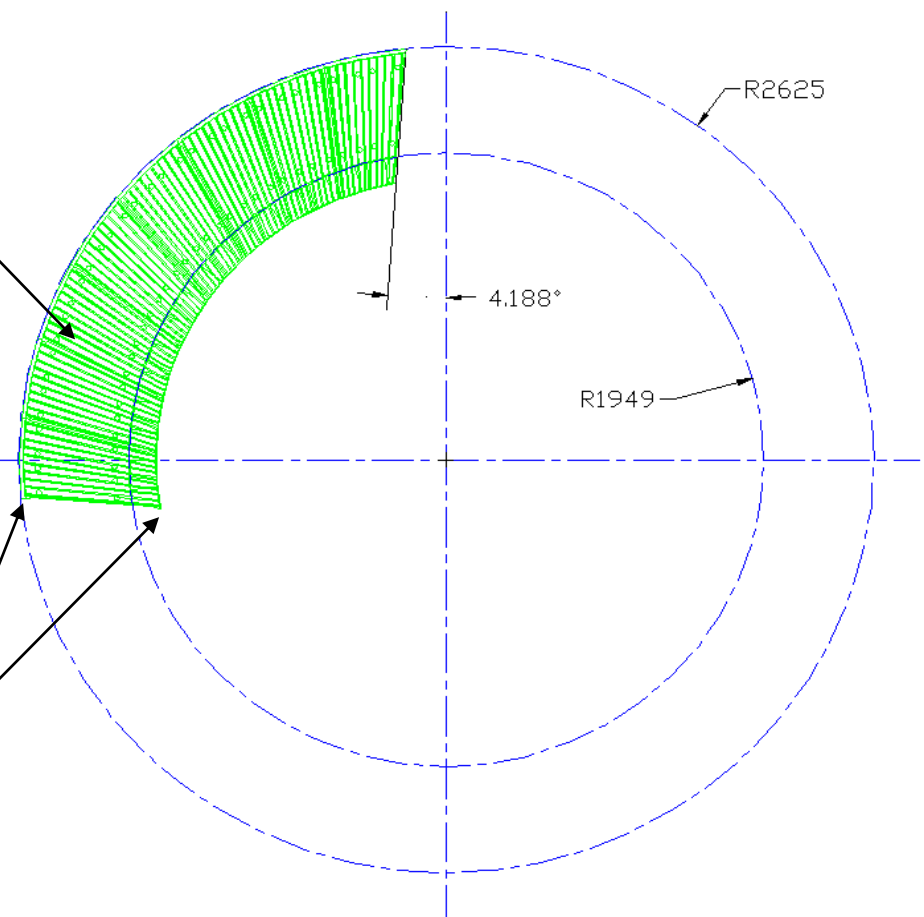
BOLTED MODULE
CONNECTION –
FRICTION
CONNECTION.
TOP MODULE
SECTION CAN ROTATE
AND
MAKE ASSEMBLY
IMPOSSIBLE



ASSEMBLY DEFORMATION

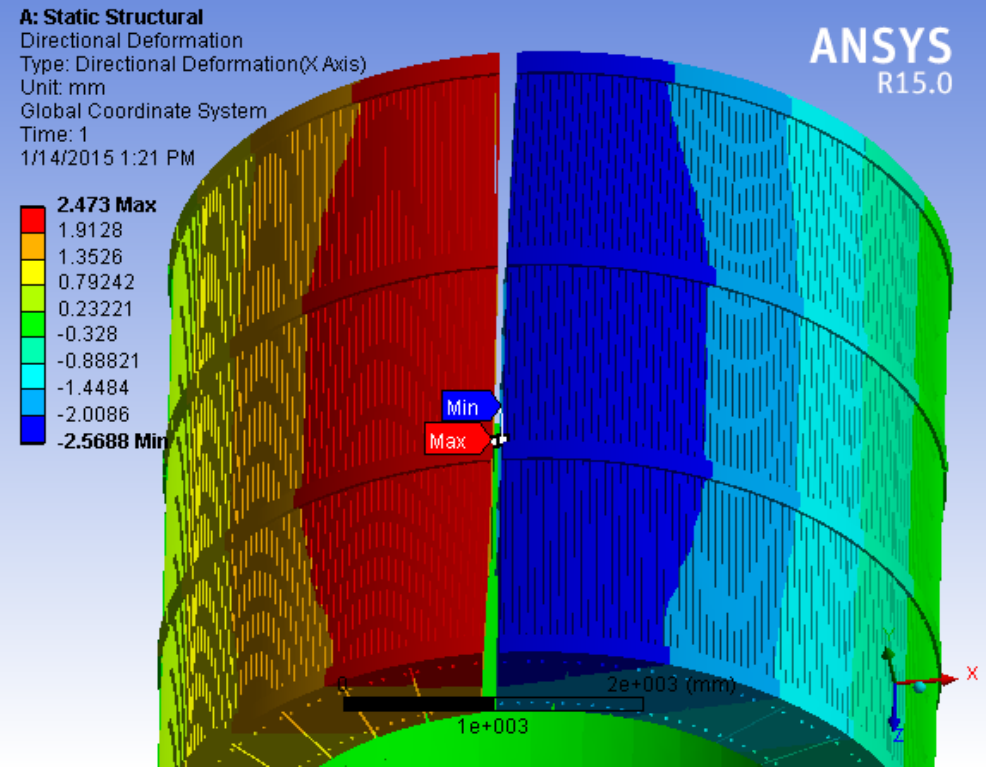
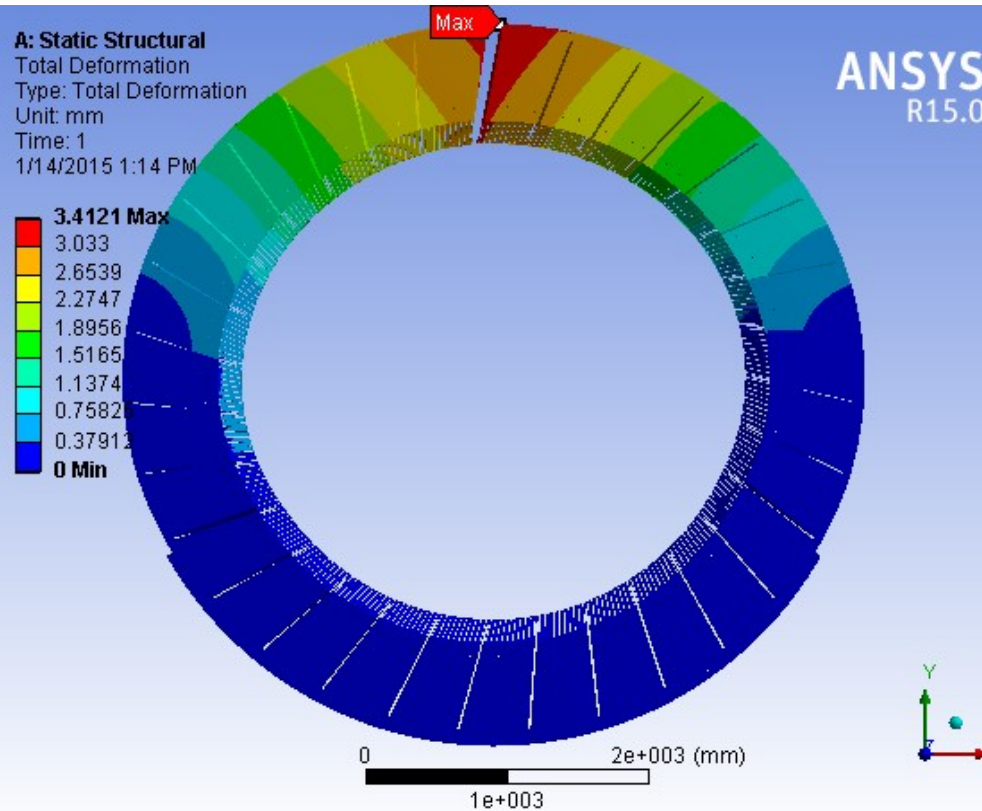


2.3mm DEFORMATION



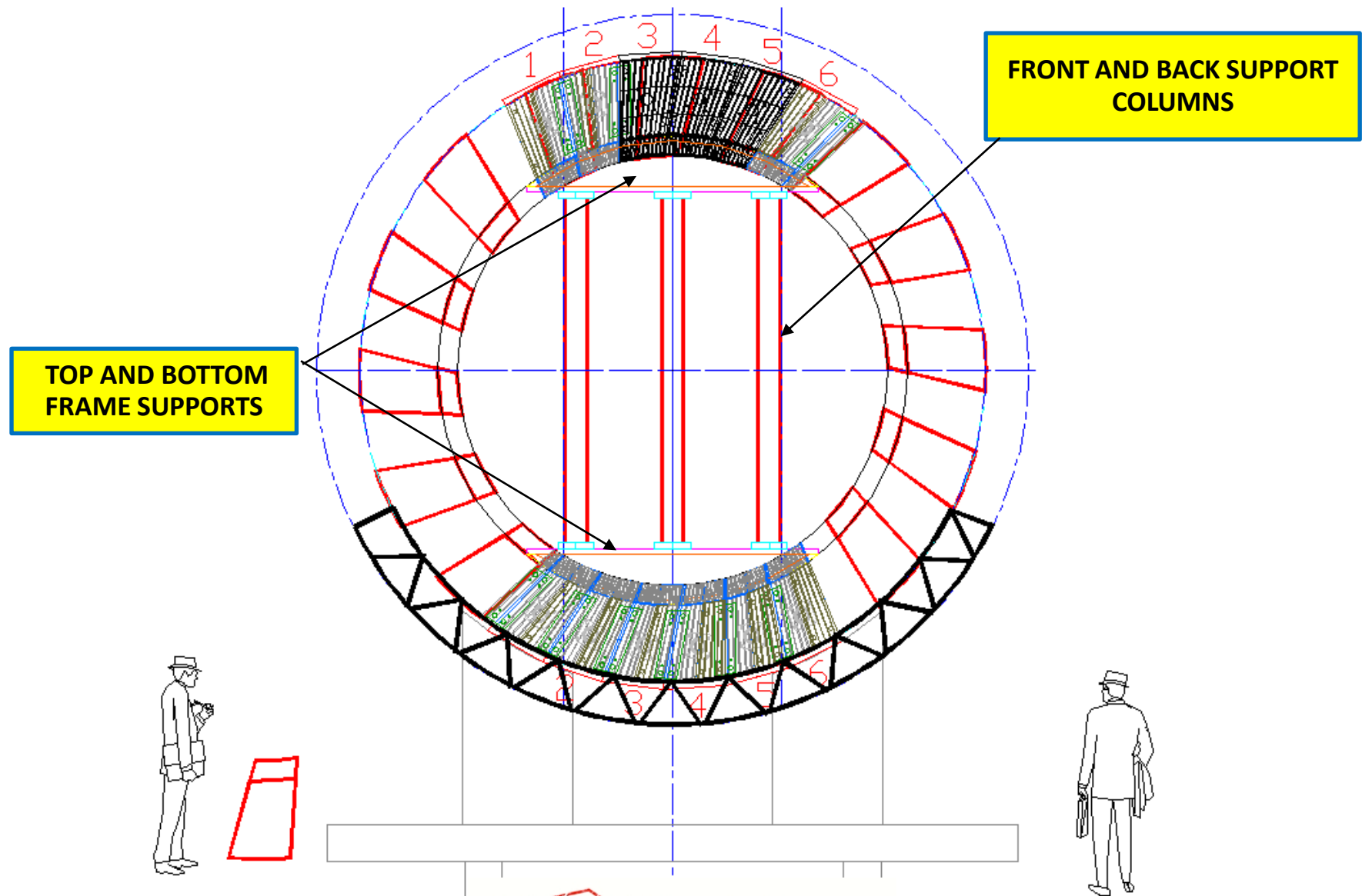
**DEFORMATION IS TOO GREAT
FOR INSTALLATION OF REMAINING
MODULES**

ASSEMBLY DEFORMATION



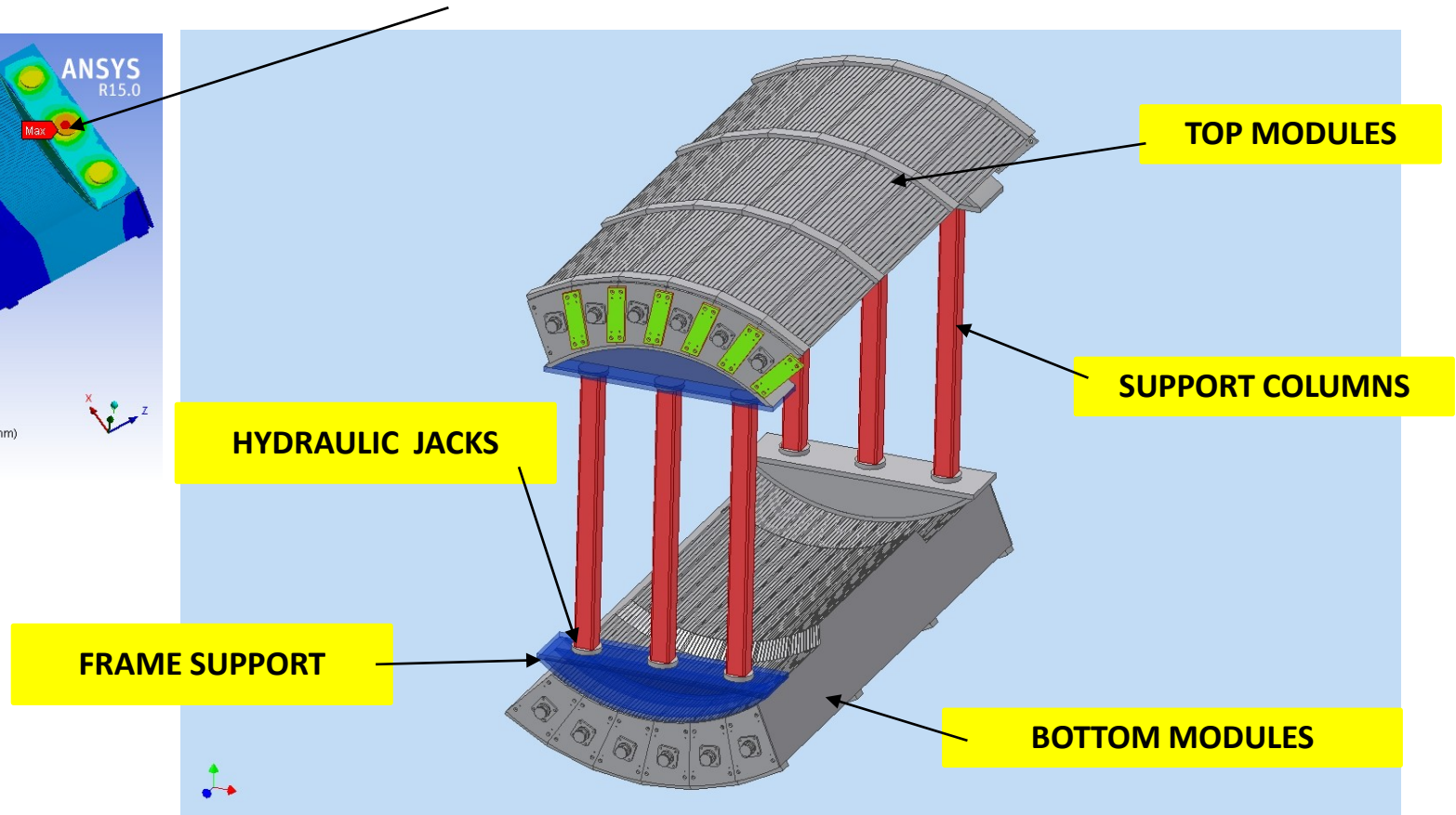
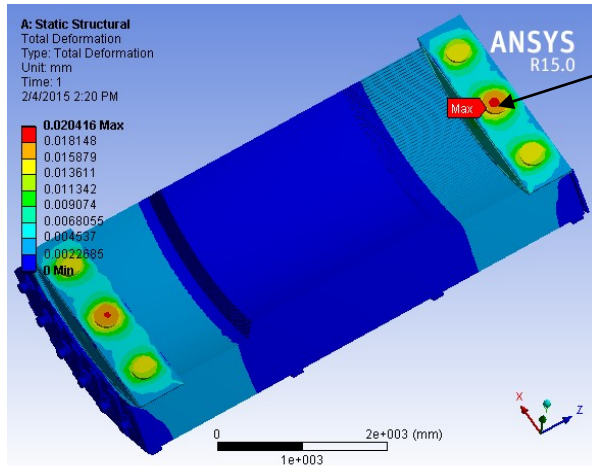
**AN EXTERNAL SUPPORT IS REQUIRED
FOR REMAINING MODULES TO BE INSTALLED**

TEMPORARY SUPPORT FOR TOP MODULE INSTALLATION



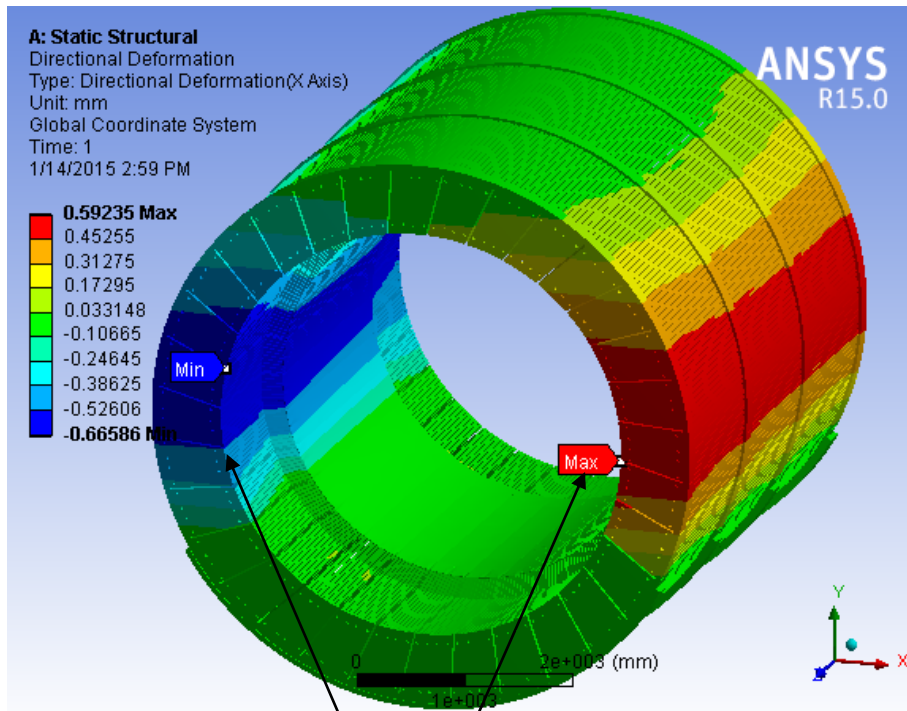
TEMPORARY SUPPORT FOR TOP MODULE INSTALLATION

FRAME SUPPORT DEFORMATION IS ONLY 0.02mm

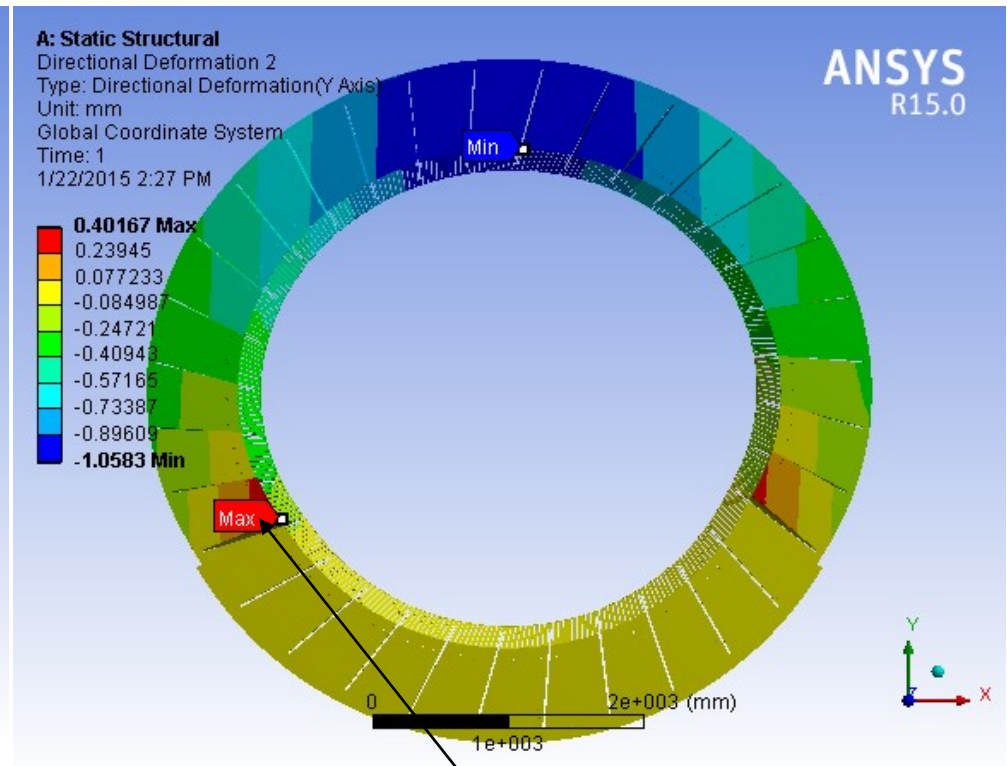


DEFORMATION DOES NOT EFFECT LOWER HCAL MODULES INTERNAL STRUCTURE

COMPLETED ASSEMBLY ANALYSIS



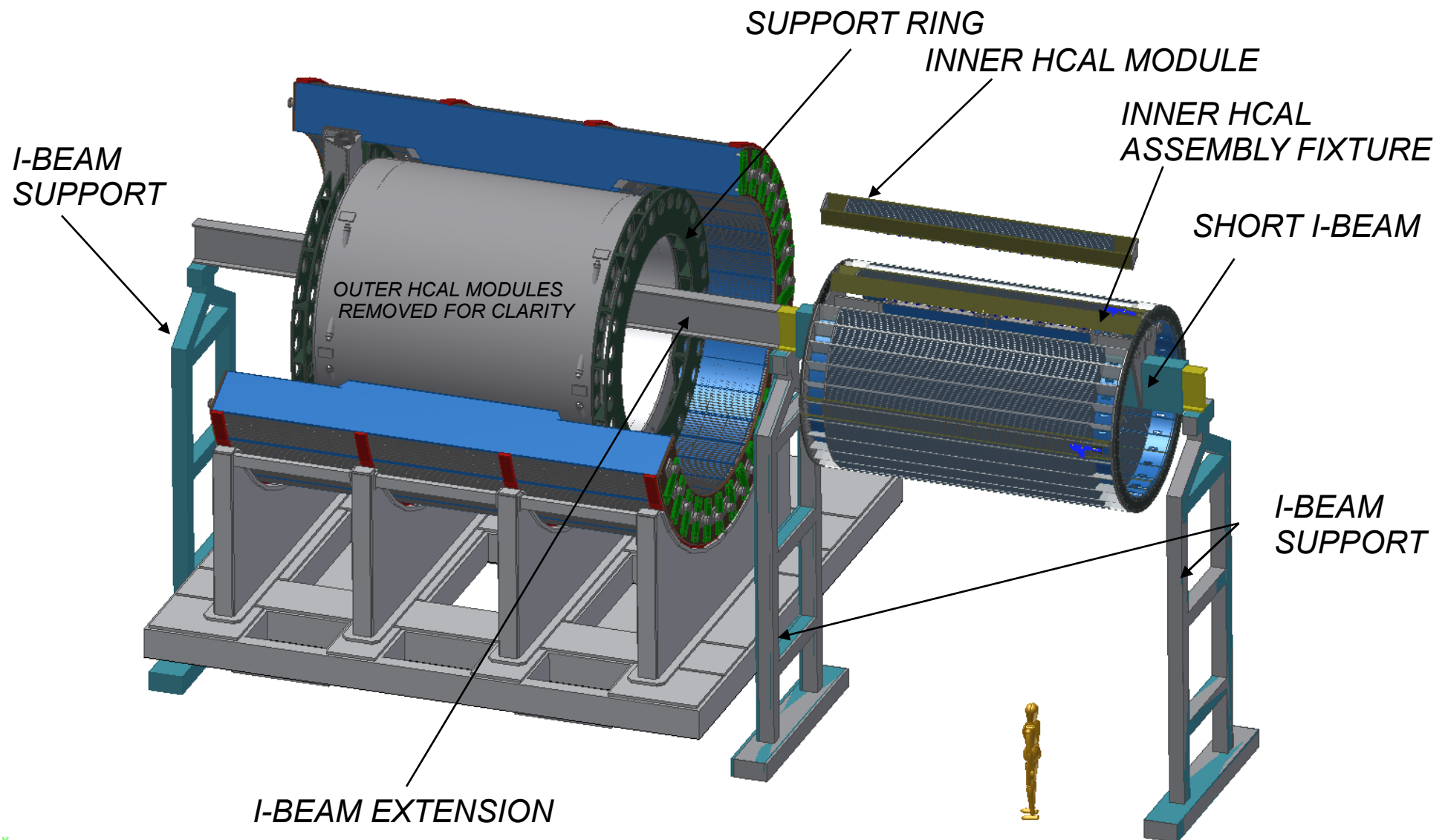
X DEFORMATION +/- 0.6mm



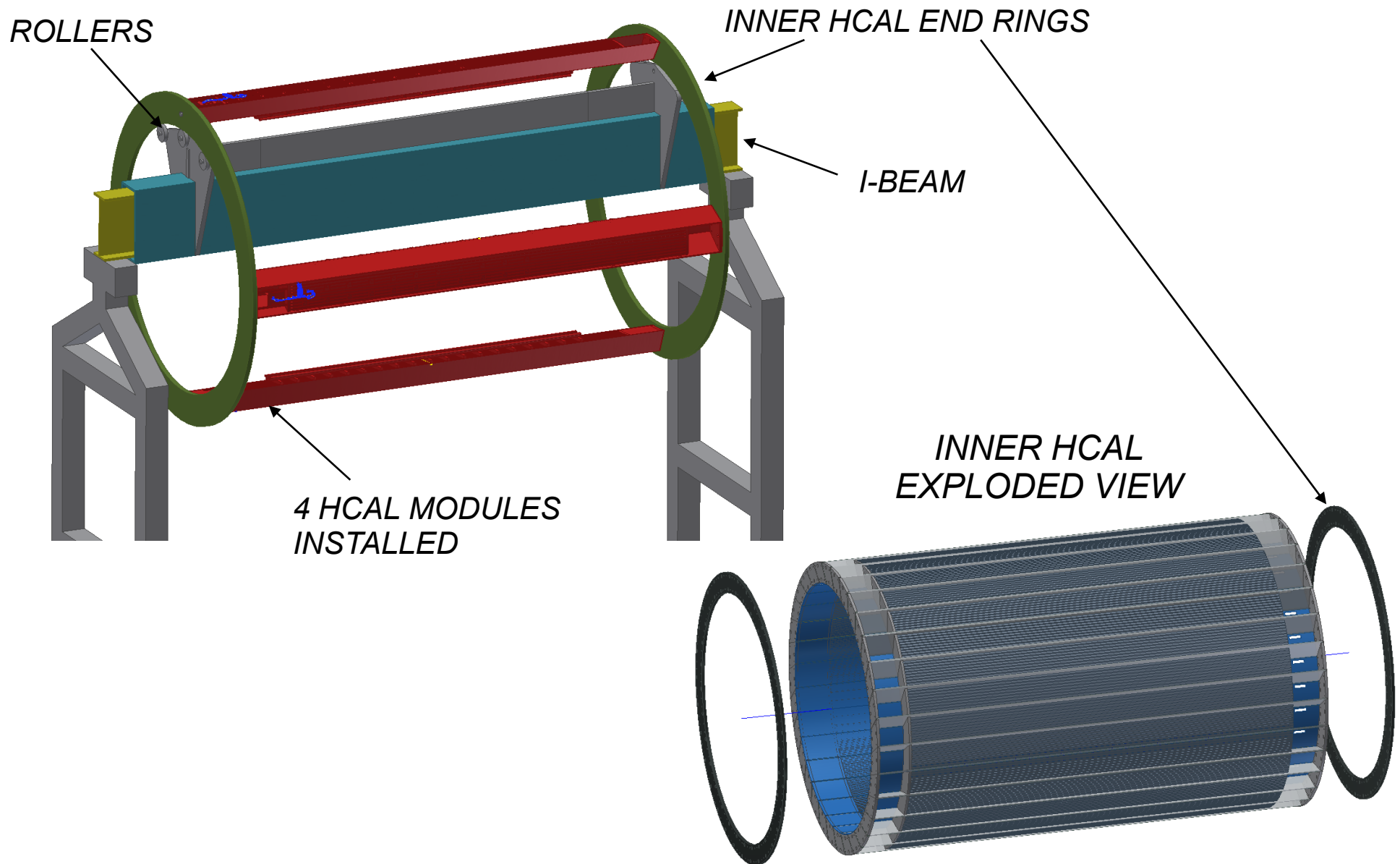
Y DEFORMATION 1mm MAX

FINAL ASSEMBLY DEFORMATION IS WITHIN TOLERANCE

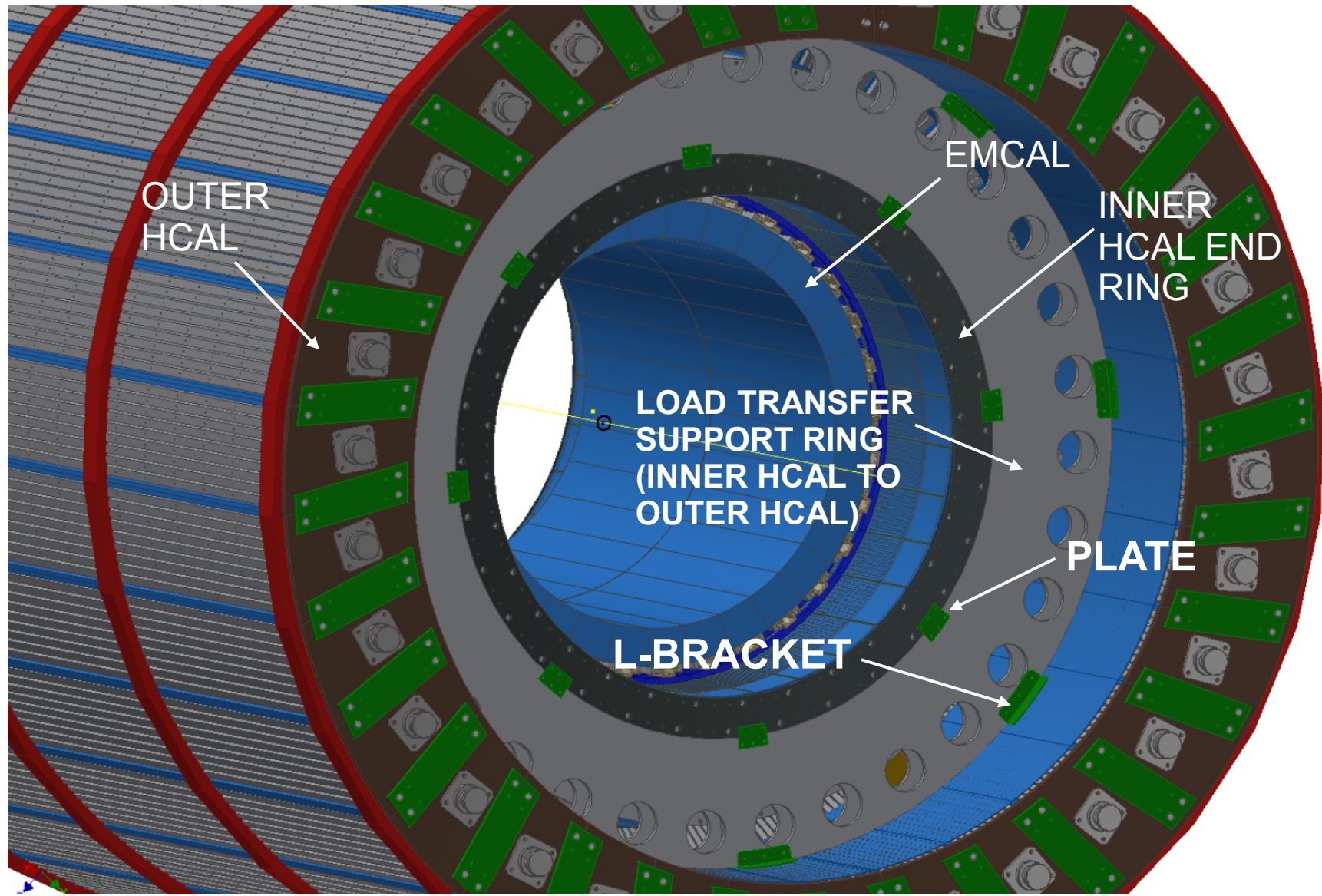
INNER HCAL INSTALLATION



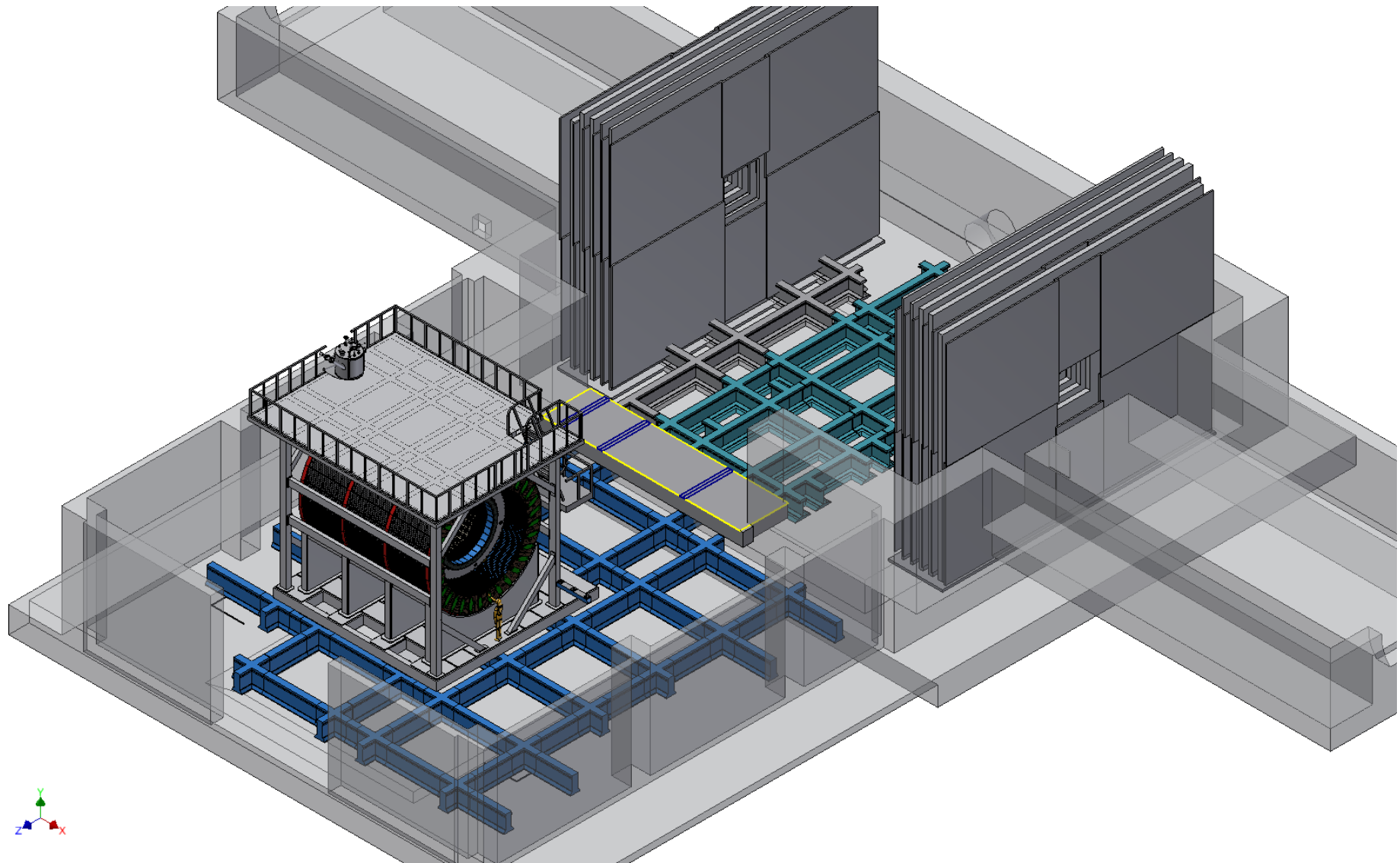
INNER HCAL INSTALLATION FIXTURE



INNER HCAL ATTACHMENTS



COMPLETED HCAL INSTALLATION



BACKUP SLIDES

HCal Design Parameters

HCal Outer

32 Modules, 1006 magnet steel, tapered plates, tilted at 12° (w.r.t. radius)

360° coverage, each module has (10) 8.5 mm slots for scintillators (7 mm th)

Inner radius 187 cm, outer radius 263.5 cm

Length 619 cm

HCal Inner

32 Modules, stainless steel tapered plates, tilted at 32°

360° coverage, each module has (10) 8.5 mm slots for scintillators (7 mm th)

Inner radius 113.5 cm, outer radius 137 cm

Length 366 cm

General

5 cm clearance between components

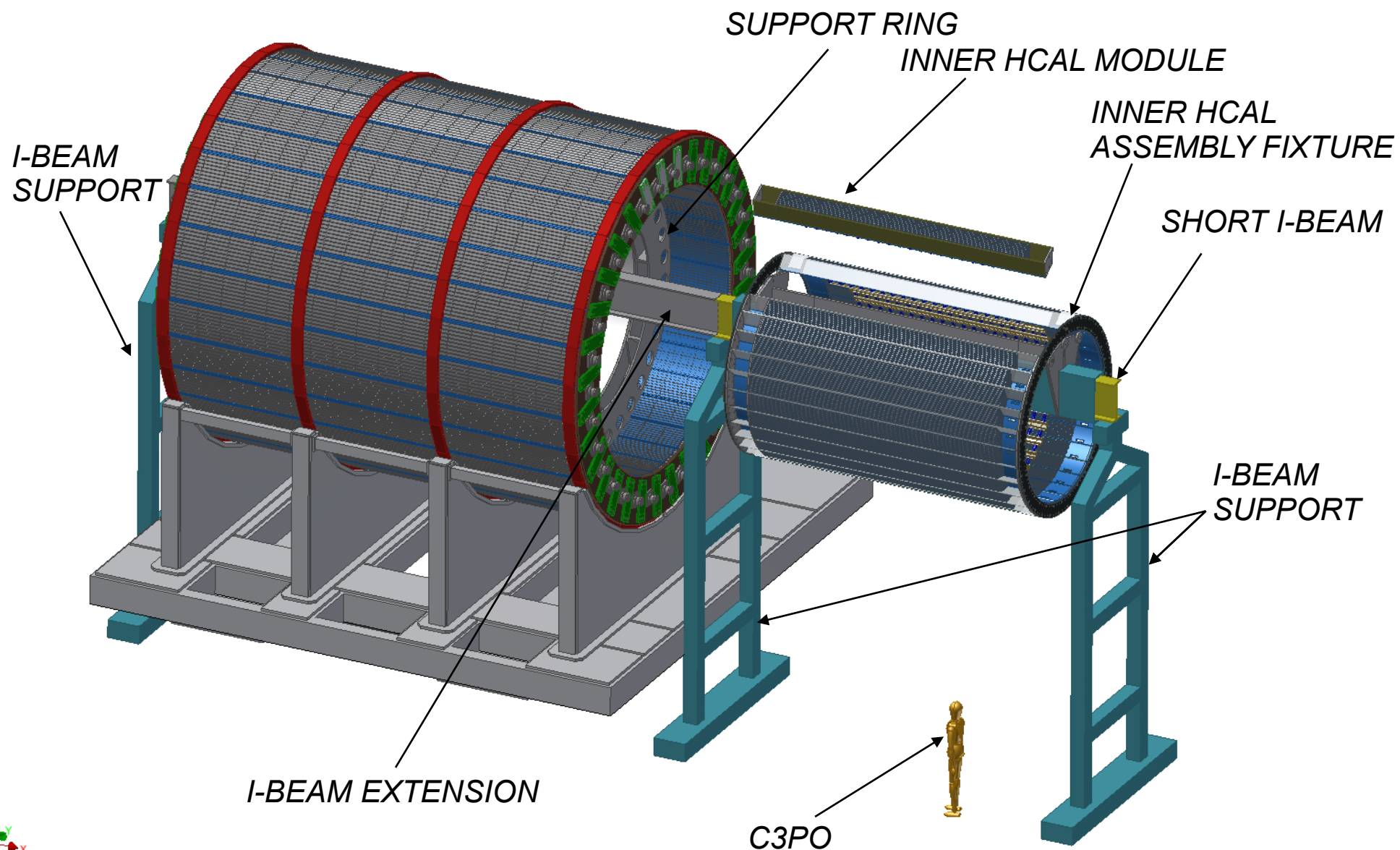
Modules to be individually light tightened

Dimensional tolerances under analysis

SiPM's, scintillator tiles and detector preamps are inaccessible when installed

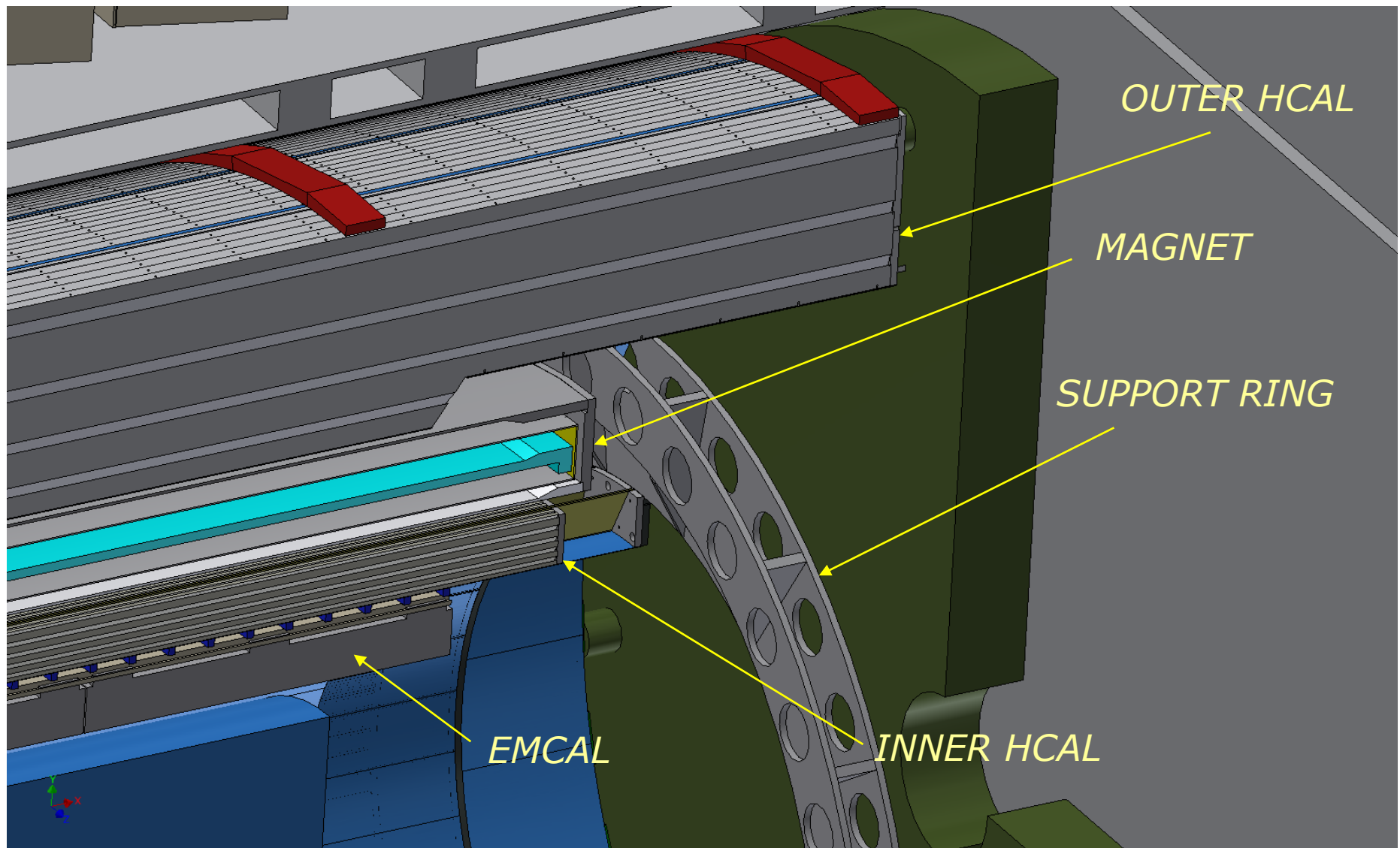
Modules to be individually assembled and tested in Factory then shipped to 1008

INNER HCAL INSTALLATION

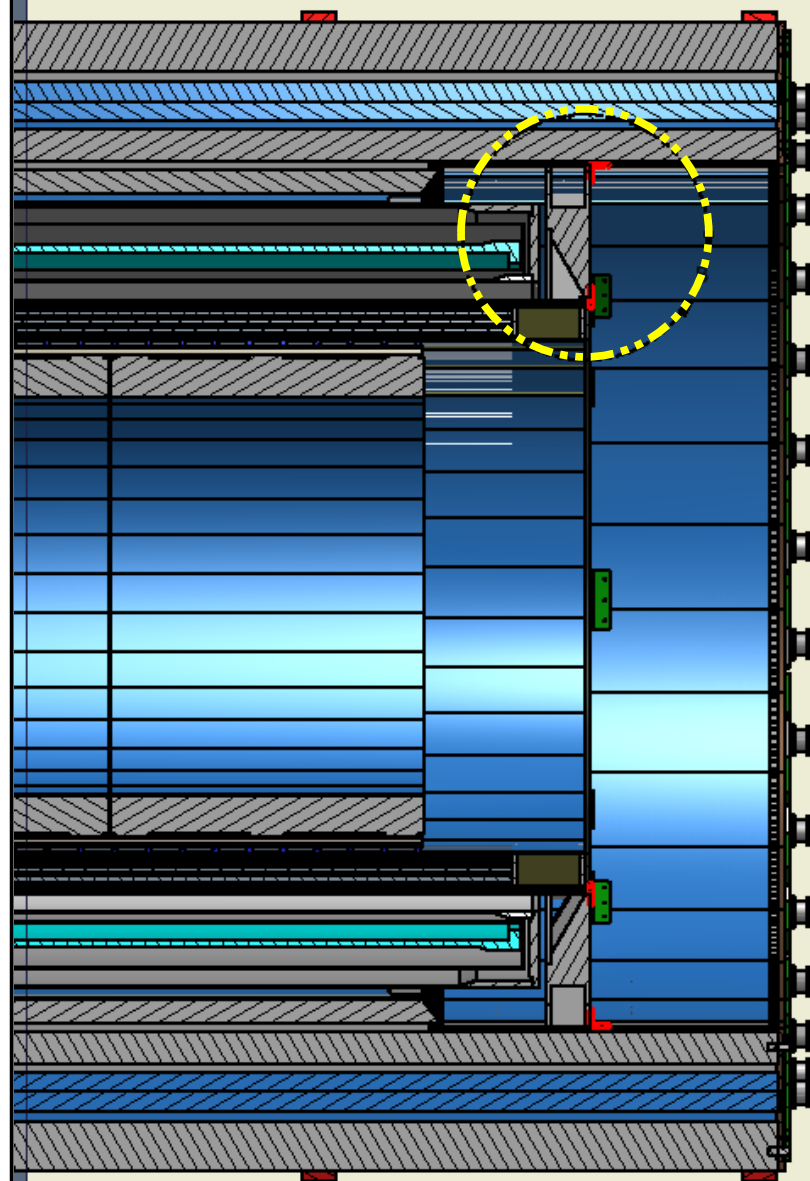


BNL, D. Lynch, R.Ruggiero, A.
Gordeev

CUT AWAY VIEW

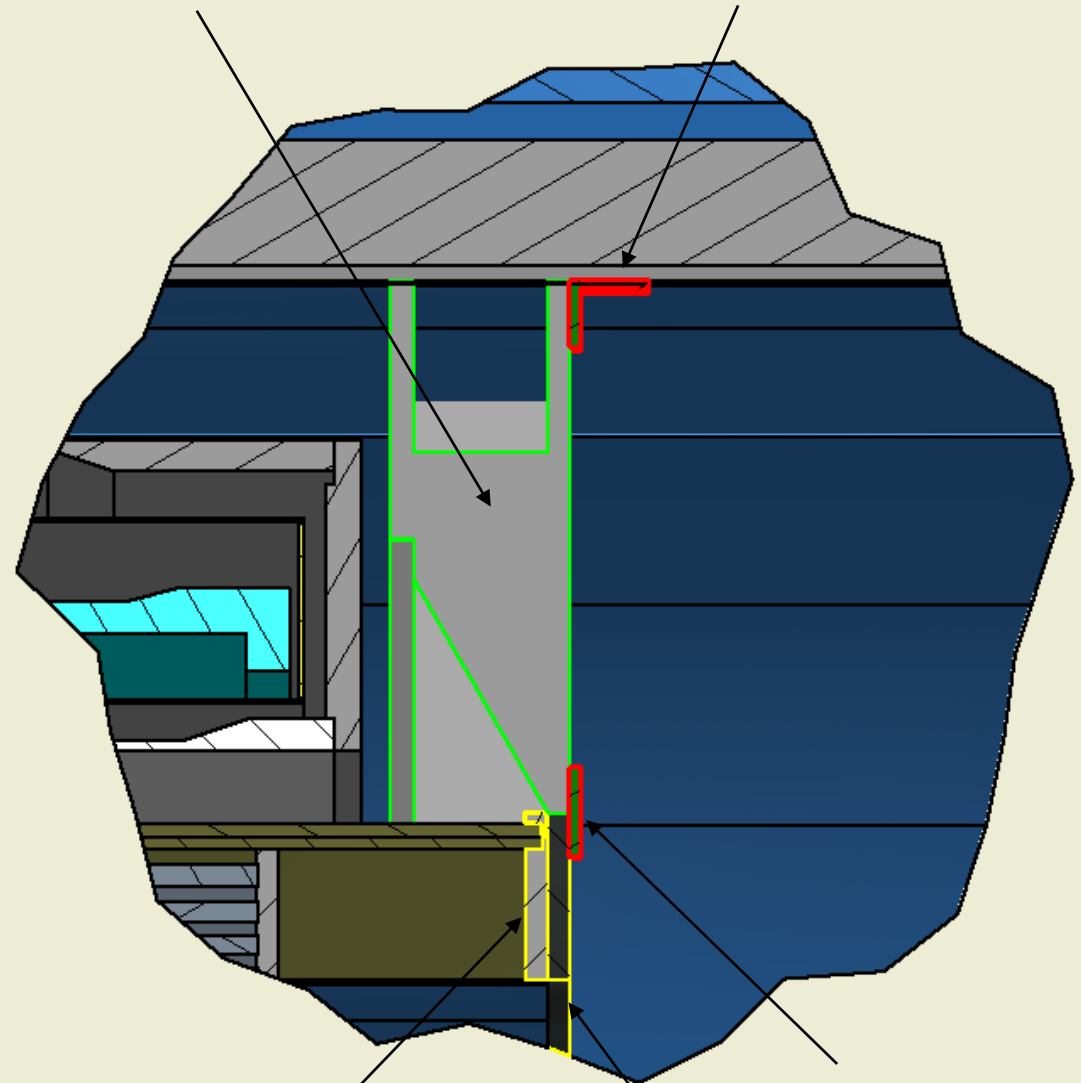


SUPPORT RING CROSS SECTION



SUPPORT RING

L-BRACKET

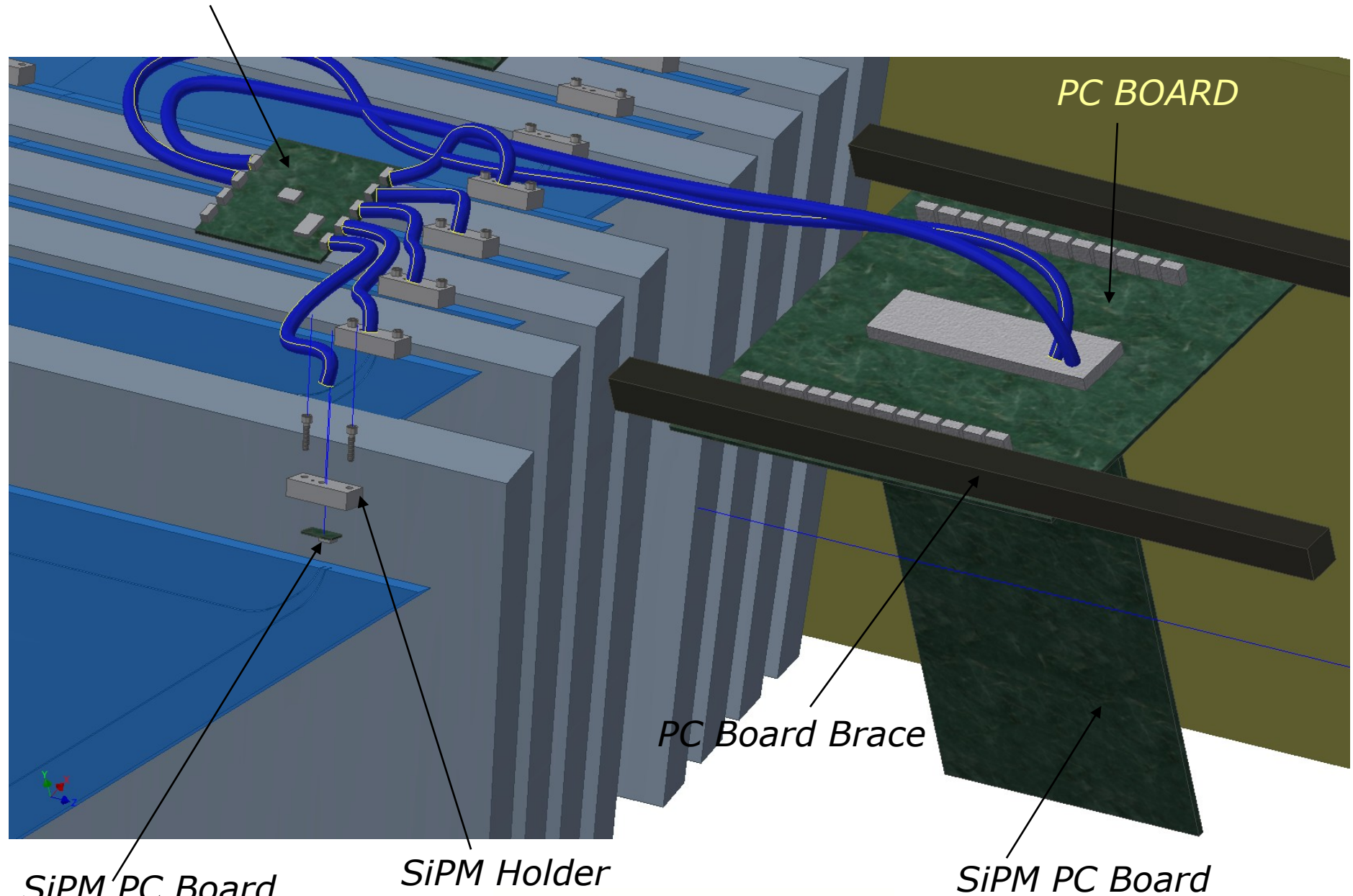


InnerHCAL ENDPLATE

SPLICE PLATE

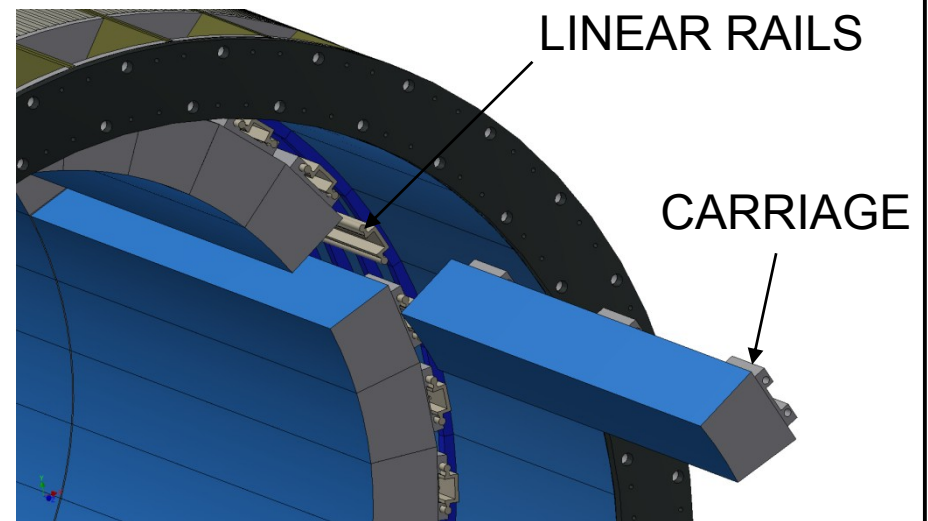
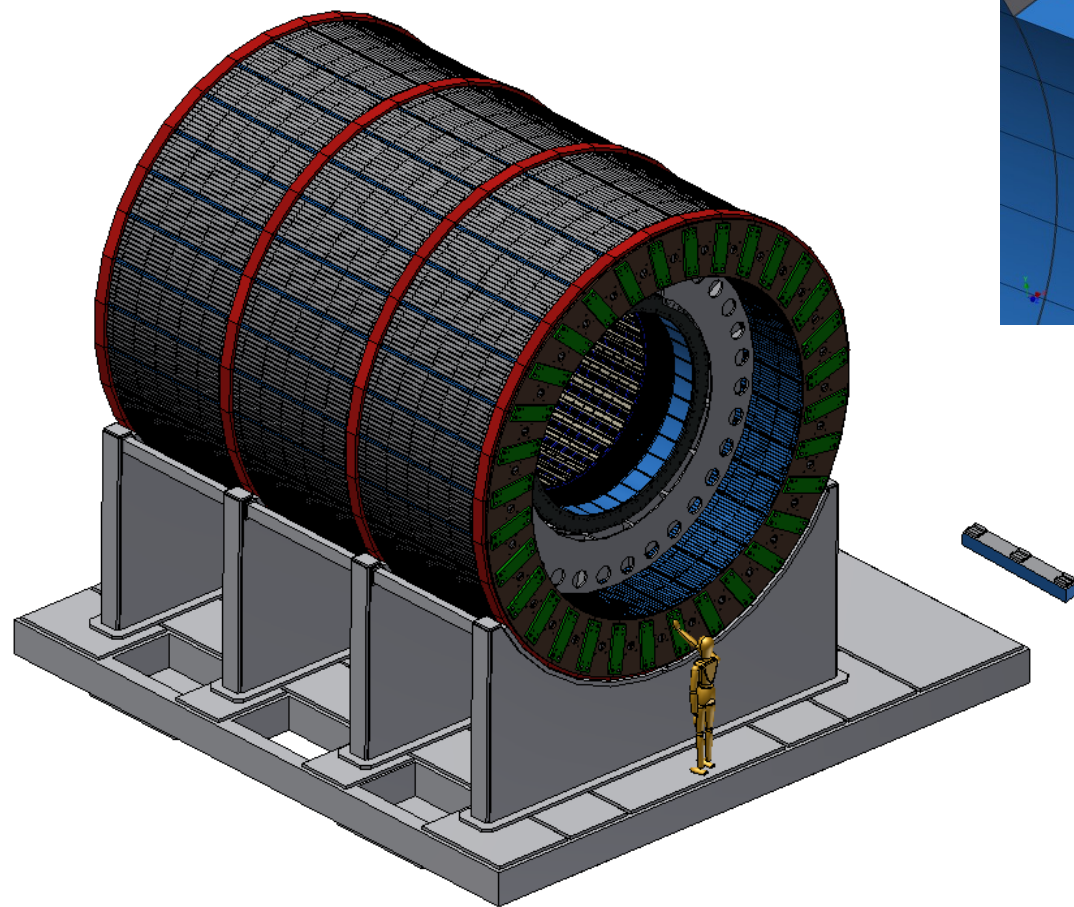
Inner HCAL SUPPORT END RING

TOWER BOARD



2/23/2015

EMCAL MODULES ATTACHED TO INNER HCAL



SUPPORT RING ATTACHMENTS

